Serious Games Cookbook

A beginner's guide to using and designing serious games

GamEngage

ISBN: 978-1-911675-13-6

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About GamEngage and the Serious Games Cookbook

GamEngage is a project that brings together serious game researchers, developers, and practitioners to explore new opportunities in using serious games for climate change adaptation and resilience building (project website: GamEngage.org). The Serious Games Cookbook is a writing project under GamEngage. It aims to support the use and design of serious games, by presenting a resource full of detailed guidance. Each section talks through major topics around the use or design of serious games, supported with tasks, questions, and multiple examples. By the end, beginners should better understand how to use serious games and design their own games.

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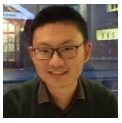

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Acknowledgements

The GamEngage and its Serious Games Cookbook are supported by the Innovation for All grant from Cardiff University, the Cardiff Innovation Development Scheme, the Hazel Prichard Impact Prize from the School of Earth and Environmental Sciences at Cardiff University, and the Institute for Global Sustainable Development at the University of Warwick. The authors wish to thank all those who assisted in developing the Serious Games Cookbook in the GamEngage network, including the participants in the cookbook evaluation meetings and workshops. We would like to offer our special thanks to the following researchers, who provided constructive feedback and insightful contributions in various stages of the writing journey: Dr Aleksandra Solińska, Dr Lyle Skains, Prof Shujun Li, Dr Wei Liu, and Ms Beilu Duan.

Suggested citation

Whitby, M., Mao, F., Stawarz, K., Marrero, S. & Walton, J.L. (2024) *Serious Games Cookbook: A beginner's guide to using and designing serious games*. University of Warwick Press. Available at: https://doi.org/10.31273/978-1-911675-13-6

Contents

Introduction

We present the *Serious Games Cookbook*, a resource including detailed guidance on how to use serious games as well as highlighting important aspects to consider when designing your own games. Everything within the Cookbook supports the two central goals of this resource:

1. Provide a resource for researchers, developers, and practitioners to begin using or designing their own serious games.
2. Expand the conversation about how serious games for climate adaptation and resilience building are designed.

The Serious Games Cookbook is intended to act as the designerly glue between domain expertise and development (Table 1). Do you have expert knowledge of climate adaptation or skills in software development, but are unsure of how to effectively use or design serious games? Then the Cookbook is designed for you. The following table best demonstrates the Cookbook's target audiences:

Table 1. This Serious Games Cookbook's target audiences.

Expertise	Use & Design	Development
Those with specialist knowledge, who want to explore how to apply that knowledge within games.	Those who want to begin using serious games or have plans to design their own will get the most out of the Serious Games Cookbook.	Those with development knowledge, who might want to create something for a specific purpose.

Serious game design is a skill that the Cookbook intends to teach step by step from first using a serious game to creating your own. Overall, we hope to inspire and empower the Cookbook's readers to meaningfully engage with serious games not just for climate adaptation or resilience building, but more broadly.

Tooltip: What are Serious Games?

Serious games are games designed for more than just entertainment (e.g., training, advertising, simulation, or education) (Susi et al., 2007). They leverage the captivating power of games to engage their players for a specific purpose (Corti, 2006), such as making their learning more fun or reflective (Iacovides & Cox, 2015), cultivating systems thinking and problem solving skills (Varma and Liu, 2022), encouraging empathy through a new perspective (Flanagan, 2007), letting them explore physically impossible situations (Squire & Jenkins, 2003), and enabling them to collectively develop possible strategies to achieve desired futures (Mochizuki et al., 2021).

How to use this Serious Games Cookbook

As the title tells, the best way to describe the Serious Games Cookbook is to consider it a “cookbook”, providing information and instructions to begin using or designing serious games. The Cookbook focuses on climate change, but the principles can be used in any domain. The sections are ordered to guide you step by step, building on the lessons taught along the way. The Cookbook is split into two core roles, each focusing on a different approach to serious games.

Table 2. Roles within the Serious Games Cookbook.

Users	Designers
Users are anyone who wishes to use serious games to support their goals. This might include educators, researchers, or facilitator.	Designers are anyone who wishes to develop a serious game, from widespread digital applications to bespoke physical board games (and everything in between).

You can follow the Serious Games Cookbook as a journey from one role to the other. The focus starts by teaching you how to use serious games, all the way to beginning to design your own. The Cookbook is divided into seven “considerations”, each representing a specific topic for you to focus on because:

1. They have a direct impact on how a serious game should be used or designed.
2. They help shape the use and design of serious games to be more impactful and engaging.

Each consideration includes:

- ***Overview.*** An explanation of what the topic is and why it is worthwhile to consider, supported with relevant literature.
- ***Example scenario.*** The topic is explored through a brief fictional example, where someone uses or is developing a serious game in different contexts.
- ***Task.*** A directed task that takes the key information from the topic into action of utilising or developing a serious game.
- ***Questions to consider.*** A collection of focused questions, that through the process of trying to answer them should help complete the task.
- ***Example games.*** Each section ends with a celebration of some games that successfully demonstrate the topic.

Content overview

This Serious Games Cookbook consists of three chapters. Following the Introduction section, the next two chapters address using (Table 3) and designing (Table 4) serious games respectively.

Table 3. Contents in the *Using Serious Games* chapter.

Category	Description
Goals of play	When choosing to use a serious game (whether in an education or research application scenario), the goals you want the players to reach during play impact which games you should use and why.
Selecting a game	How do you determine which game to use? Sometimes the best results happen when taking existing games (serious or otherwise) and adapting or framing the content to better fit your core message. This consideration begins to bridge the gap between using serious games and attempting to create them.
Game facilitation	There is more to utilising serious games than just playing them and exactly how the games are introduced to players shapes their expectations and attitudes going into the session. Equally, what happens after play is important for encouraging post-play reflective thought or producing lists of actionable next steps.

Table 4. Contents in the *Designing Serious Games* chapter.

Category	Description
Game content & themes	One of the first choices to make when creating a game is to establish the types of content (realism to fantasy) and how the themes are explored (explicit to abstract).
Mechanics is the message	Players interact with games through its mechanics, so it is desirable for the systems of the game to support or embody the message and themes you want to present.
Remember the player	While developing a game, you must constantly remind yourself of the intended players and how each design decision can impact the overall player experience.
Strategies for shifting attitudes	When creating a game to help players understand a subject, there are a number of strategies that can be incorporated into a game to encourage reflection or a shift in beliefs & attitudes.

Serious games background

Before we can dive into using or designing serious games, it is useful to understand the years of research that have allowed serious games to flourish. But what is a "serious game"? It sounds contradictory, because games are expected to be fun. A good serious game usually *is* fun, but it is not *just* fun. The generally agreed meaning is that serious games are games used for purposes other than mere entertainment (Susi et al., 2007). One issue with this definition is that it's not always straightforward to label a game as "serious" or not: to know whether a game has a non-entertainment purpose requires knowing the intentions of the game designer (Laamarti et al., 2014). However, if we're the ones designing the game, as the Serious Games Cookbook intends to help you do, we are purposefully creating serious games.

The interest in serious games stems from their ability to positively impact the players' development in a number of different skills and allow learners to experience situations that are impossible in the real world for reasons of safety, cost, time, etc. (Corti, 2006; Squire & Jenkins, 2003; Susi et al., 2007), with the potential of making people aware of their real situations and challenges, imagining ways of achieving a desired future and planning steps that allow them to reach it. This combination of advantages has led to the use of serious games for education, training, advertisement, interpersonal communication, and sustainable development, to just name a few.

The history of serious games is intrinsically linked to the study of play, tracing back to Plato (and even further before), who proposed that reinforcing behaviours in children's play would reinforce similar behaviours in adulthood (Wilkinson, 2016). Supporting the link between play and learning, Jean Piaget suggested that "play is the work of childhood". Economists and political scientists grew interested in games as models of human behaviour around the middle of the 20th century, leading to the development of game theory. Mildred Parten, Johan Huizinga, and Roger Caillois were also among those studying play from sociological, historical, and cultural perspectives (Kudrowitz & Wallace, 2010), prior to the emergence of game studies (or "ludology") in the 1980s, as computing and digital games grew more prevalent. While it is difficult to pinpoint the first "serious game", we can see how serious games have their roots in a long history of theorising the relationship between play and learning. The term "serious games" itself is credited to Clark Abt, who worked in a U.S. research laboratory during the Cold War (Abt, 1987). Abt's work aimed to use games for both training and education (Djaouti, 2011), leading to the development of the serious games field as we know it today.

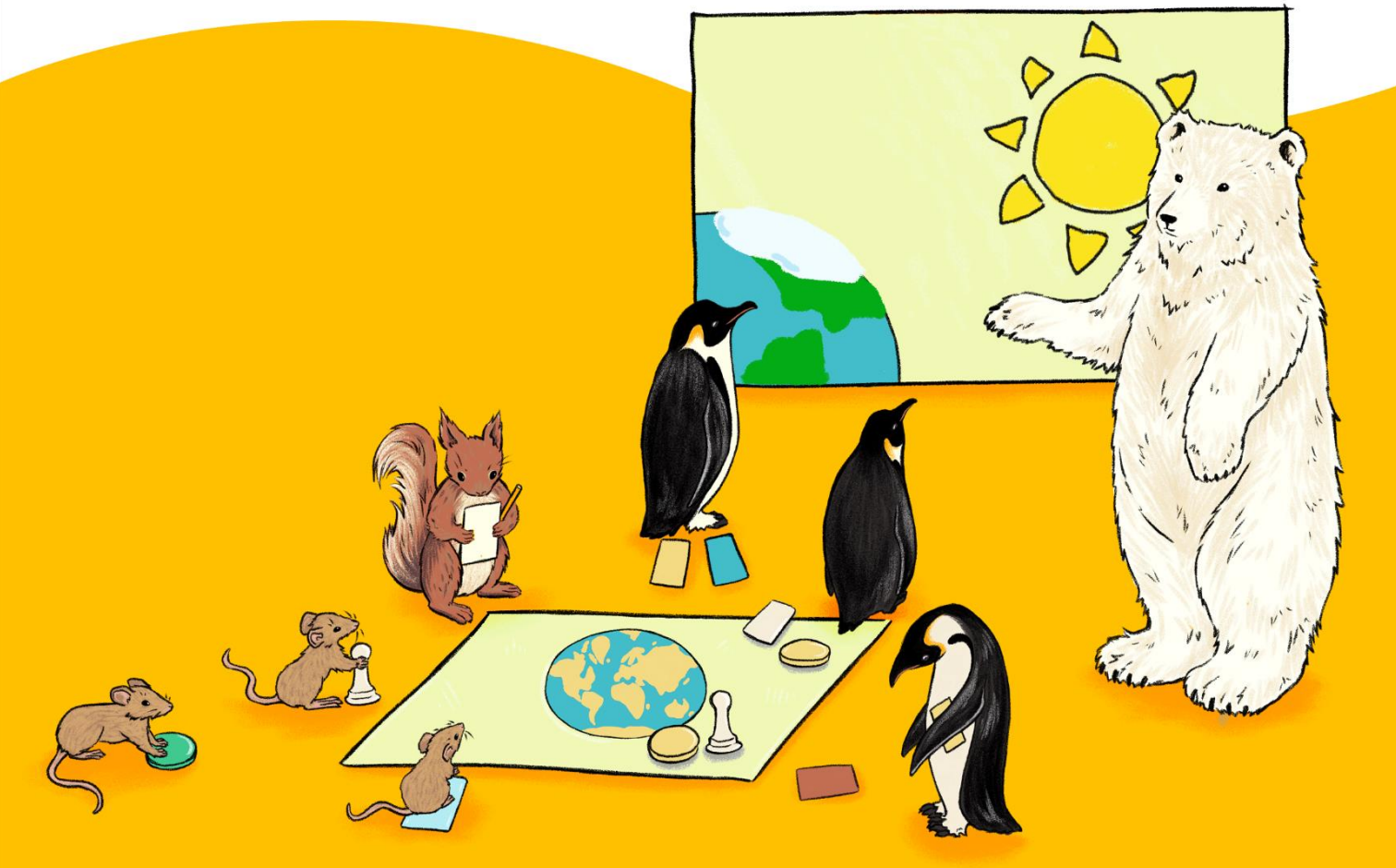
It is worth noting some other terms that partly overlap with "serious games". For example, "edutainment" is any media intended to be both educational and enjoyable (Colace et al., 2006); by contrast, "serious games" refers only to games, and includes purposes other than education. There is also "gamification", which typically means the use of game

design elements in non-game contexts (Deterding et al., 2011), contrasting with serious games which are explicitly focused on game contexts. The differences between gamification and serious games also include the means by which “a goal” is reached. Gamification implies competition rooted in individual goals, whereas serious gaming is more about collaboration and communication to reach a common goal. Lastly, there are games with a purpose (GWaP) which aim to solve large-scale open problems using collective human brainpower (via games). However, we argue that serious games differ from GWaP in who ultimately benefits from playing. Serious games aim for the players to leave the experience having gained something, whereas for GWaP the developers or stakeholders benefit from the game being played. Examples of GWaP include Foldit (https://fold.it/) and Quick, Draw! (https://quickdraw.withgoogle.com/).

And there you have an abridged background of serious games, from the philosophical underpinnings and history of emergence. We encourage you to follow any of the references to learn more about the field, however for the purposes of the Serious Games Cookbook you’re all caught up. It is an exceptionally exciting time to get involved in serious games, not only for all their advantages but also how quickly the field is expanding. For example, it is estimated that the serious games market will reach $17.39 billion in 2026 (ReportLinker, 2022). Additionally, on a research front the number of publications has risen exponentially since the 2010s (Laamarti et al., 2014). The field of serious games continues to grow, and with the Cookbook we’re hoping to encourage you to help by using and designing your own games.

Using Serious Games

When we say users of serious games, we're not referring to the players but instead the researchers, practitioners, and moderators who present the game to be played. The Serious Games Cookbook outlines some approaches to begin using serious games, from understanding different goals of play, factors in selecting a game, and how to embed the game within wider activities.



Process of using a serious game

We outlined just a few of the benefits of using serious games, how they can be more engaging, fun, and reflective for players. But, how do you go from being curious about serious games to using them in practice? Generally, the process of using a serious game is divided into five steps:

- ***Establish goals.*** Identify what you want to achieve from using a serious game, who your target audience is, and other contextual factors (e.g., setting, audience size, time restraints).
- ***Find a game.*** Now, you need to select a game that matches the goals of play you've established. This can involve scouring the many databases, or perhaps creating your own (detailed in the Designers section). In some cases, an existing game might need to be modified slightly to better fit your goals.
- ***Plan facilitation.*** With a game selected, plan how it can be integrated into your lesson, workshop, or event. Facilitation includes everything that happens before and after play.
- ***Run the session.*** Everything is planned and prepared, now it is time to play!
- ***Reflect & adjust.*** After the session, consider how the game was facilitated (e.g., what went well and where are areas for improvement). Did you successfully meet your goals? How can the session be adjusted to be even better?

The following sections of the Serious Games Cookbook provide guidance from (1) Establishing Goals to (3) Planning Facilitation, after that point the rest is up to you!

Goals of play

Overview

In order to get the most out of using a serious game, you must first get a strong understanding of why you're using games and what you want your players to get out of the experience. One of the strengths of serious games is their ability to be applied within a range of goals, including (but not limited to) training, education, management, and improving social awareness.

The combined why and what of using a serious game establishes the goal of play, an understanding of the purpose and goal of playing a game. To help identify your goal of play, we've highlighted four areas to use serious games and what an example desirable outcome might be (Table 5).

Table 5. Areas to use serious games.

Educate	**Problem solving**
Serious games provide the chance for players to learn experientially, by playing with new concepts. A desirable outcome is that the player(s) leave with a better understanding of how something works or experience in applying a new skill.	A problem solving goal focuses on trying to explore different ways to address an issue through the game. A desirable outcome is for the player(s) to identify actionable next steps on how to address or apply a new skill for problem solving.
Raise awareness	**Research**
Raising awareness shares similarities with education, however, is more applicable outside of a classroom setting for wider audiences. A desirable outcome for raising awareness is for the player(s) to leave having considered topics they otherwise would've never thought about and/or adopt a new perspective or attitude towards emerging challenges.	A research focused context might involve studying how a serious game works in the other contexts or how the players respond during play. A desirable outcome for research is more output driven, in that the players might be able to provide data (e.g., in the form of feedback, interviews, etc.).

When establishing the desirable outcomes for your players, it is vital to determine who exactly your target audience is. Are they a classroom of students or a boardroom of professionals? The audience dictates the goal of play as much as the reasons why you want to use a serious game. A misalignment of the goals with the audience results in the potential of serious games being ultimately wasted.

Example scenario: Identifying the goal of play

In order to give a better example of how serious games might be applied in each of the four suggested contexts, here are four scenarios related to climate change:

- ***Educate.*** A classroom might utilise a serious game to educate the students of the disastrous effects when people fail to adapt to a changing climate. A game could let the students experience simulations of those dangerous situations, and what can be done to build resilience.
- ***Problem solving.*** A workshop for policymakers could utilise a serious game to explore different solutions of retrofitting to reduce the impact of climate emergencies.

- ***Raise awareness.*** A library holding an environmental open day might use a quick-paced game to raise awareness of how different modes of transport vary in their impact on the environment.
- ***Research.*** A research project involving a serious game could review how attitudes around climate change shift before and after play. Alternatively, they could be interested in how well the serious game educates, problem solves, or raises awareness within its players.

Establishing the goals of play (e.g., the why and what) is the first step because of how it impacts the choices of what types of serious games you select and how the game is facilitated within a session. There are downsides to using serious games (e.g., focusing on the play more than the content), however by knowing exactly why you're using the game can help avoid the more common pitfalls.

Task

Review the four suggested areas to use a serious game, and consider which is most appropriate for you. Use the following "Questions to consider" to support you.

Questions to consider

- Why do you want to use a serious game?
- What do you want your players to leave the play session with?
- What do you want to get out of the session?
- Who is your intended audience?
    - What might they want to get out of the session?
    - Does it differ from you?

Example games

Climania - Climate Action Game project. Climania was designed as both an engagement and education tool for informing players about how built environments are impacted during climate emergencies. The game was developed as part of a **RESEARCH** project, but depending on the audience could easily apply within **EDUCATION**, **PROBLEM SOLVING**, or **RAISING AWARENESS** contexts (Figure 1).

Figure 1. Climania. A physical game by Shtebunaev and Carter. Image retrieved from: https://carboncopy.eco/initiatives/climania-the-climate-action-board-game.

Alba: A Wildlife Adventure - UsTwo games. Alba is an open world adventure game, where the player explores the world rescuing wildlife, conducting cleanups, and cataloguing animals. Being a more playful experience, Alba is better suited for **RAISING AWARENESS** on the impact of littering or **EDUCATING** on different animal types, rather than any of the other goals of play (Figure 2).

Figure 2. Alba: A Wildlife Adventure. A computer game by Ustwo Games. Screenshot retrieved from: https://www.albawildlife.com/.

Selecting a game

Overview

With a better understanding of why you want to use serious games and for what outcome, now comes the fun part of selecting which game to use. Even with a wide selection of games (as highlighted in the Resources to Find Games Tooltip), selecting the game that best suits your goal of play is challenging. This is why we offer four factors to keep in mind when determining if a particular game is right for you (Table 6).

Table 6. Game factors to consider.

Relevance	**Number of players**
The relevance is how much the game connects with the goals or message you want to convey. Relating the game back to your desired goal of play is a quick way to gauge how relevant it is.	The number of players include the minimum and maximum of people required. Determining your target audience would give you a better idea of how many players you need to accommodate.
Duration	**Complexity**
The duration is typically how long it takes for the player to start and finish the game. However, you always need to consider how long setting up the game might take, how long it will take to teach the players the basics, as well as how long it will take to pack up the game afterwards.	The complexity of a game describes how simple the game is to play (e.g., from Checkers to Chess). The complexity has a direct impact on the duration, as more complex games typically take longer to teach or set up.

In some cases, you might discover a game that is almost perfect, perhaps the game suggests too few players or is far too long for your intended session. You can always attempt to modify the game, although there are some games (typically digital games) that can't be modified. For example, if you needed more players out of a four-player board game, it could become a team-based game where four teams of three players work together. Alternatively, if a game has a longer duration than desirable, you could modify how the game reduces the maximum number of turns or the rate in which players gain/lose resources (depending on the particular game's mechanics).

Very basic games are easier to modify since they have fewer moving parts, which is why Snakes & Ladders has been modified multiple times to be more relevant for different topics. However, before making any drastic modifications you need to have a strong understanding of how the game works to ensure the changes don't "break" the game. In some cases, you might be able to reach out to the game's designer and ask for advice in moderating the game to better suit your needs. Also consider the time investment required to modify a game, more often than not you'll spend more time changing a game than you would playing it!

The quickest way to find out if a game suitably covers your message is to play through the game yourself (multiple times if possible). Another benefit of playing the game is that it makes moderating play or teaching the games to others easier.

Tooltip: Resources to Find Games

As interest in serious games has increased, multiple groups created collections of serious games. These are fantastic resources in order to find a game that aligns with your goals. We're unable to highlight every resource out there, but the following four databases have the largest selection of serious games:

The Serious Games Typology Project. This project, developed by The Business Team, built a global catalogue of serious games. The database holds over 400 serious games, each reviewed for their Activity Admin, Participants/Relationships, Engine/Model, Interface, and Outcomes. Link: https://typology.seriousgames.online/index.html#/start_page

Games for Change (G4C). G4C is a nonprofit organisation, focused on providing support for developers and organisations using serious games for social change. They've curated a list of over 150 digital and non-digital games that allow players to explore contemporary social issues. Link: https://www.gamesforchange.org/games/

Gamepedia. Games4Sustainability is a platform developed and run by the Centre for Systems Solutions (https://systemssolutions.org/) to support spreading sustainability messages through games, alongside their blog they host the Gamepedia which features 100+ games and simulations arranged by their Sustainable Development Goals. Link: https://games4sustainability.org/gamepedia/

Science Game Centre. The Science Game Center provides a collection of games used to educate in topics around maths and science. The 120+ games are publicly reviewed for Fun, Science, and Teaching Effectiveness. Link: https://www.sciencegamecenter.org/games

Example scenario: Modifying Snakes & Ladders

Let's take the classic game of Snakes & Ladders, which only needs a 10x10 board, a six-sided dice, and some player tokens. Some grid spaces push the player forward (ladders), while others push them back (snakes), but as the game stands it has very little to do with climate change. Let's change the end point to be energy sustainability. If we change the ladders to be with eco-friendly energy suppliers and the snakes to be burning fossil fuels, then rather quickly we have a more climate change focused version of Snakes & Ladders. Eco-friendly energy supplies are seen by players as beneficial to gameplay, whereas burning fossil fuels are best avoided.

Climate Change Snakes & Ladders is a game that already exists, developed by the Urban: Nature Project. The project designers wanted to find a game that is quick to play, suits small groups, and ultimately is easy to understand. You can look to this project as inspiration for how easily a simple game can be modified to better suit a different goal of play. Link to the game: https://www.nhm.ac.uk/schools/teaching-resources/key-stage-3/climate-change-and-biodiversity/game-climate-change-snakes-and-ladders.html

Task

Find one game and play it (even if you have to control multiple players). After playing it, review the game's relevance, number of players, duration and complexity for suiting your goal of play. Use the following "Questions to consider" to support you.

Questions to consider

- How relevant is the game's topic to your intended message?
    - How could the game's topic be modified to be more relevant?
- Does the recommended number of players suit your needs?
    - Could multiple games be played simultaneously?
    - Alternatively, how could the game be modified to suit your number of players?
- Does the estimated duration suit your needs?
    - Is there a particular part of the game you could focus on?
    - How could the game be modified to be quicker or longer?
- Is the game's complexity suitable for your target audience?
    - How quick is it to teach new players the basic rules?
    - How could you modify the game to be more or less complex?

Example games

Earth Opoly - Late for the Sky. Earth Opoly is essentially a modified version of Monopoly remaining low in **COMPLEXITY** (suitable for ages 8+), except made more **RELEVANT** for Earth-friendly practices. The game accommodates 2 to 6 **PLAYERS**, with alternate rules for a 1-hour **DURATION**. Players familiar with Monopoly would be able to quickly pick up the game's rules, while the differences draw their attention to the message Earth Opoly wants to tell (Figure 3).

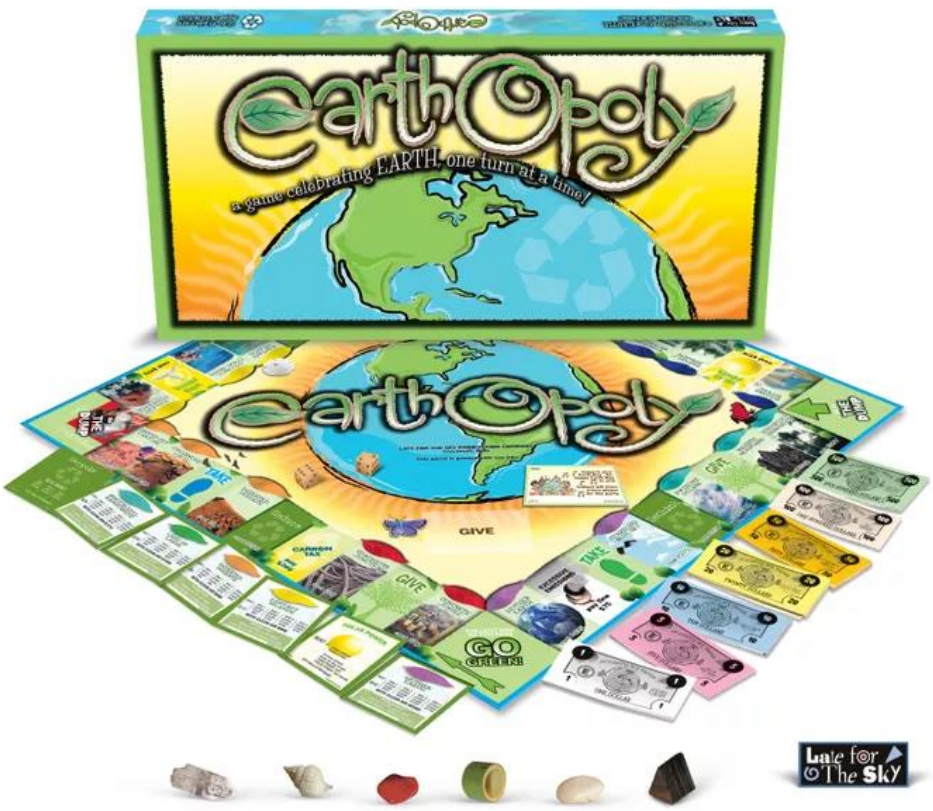


Figure 3. EarthOpoly. A physical game by Late for the Sky. Image retrieved from: https://boardgamegeek.com/image/1013879/earthopoly.

Ludwig - ovos. Ludwig is a single-player adventure game, in which the player explores the different forms of energy production from combustion all the way through to renewable approaches. The game is **RELEVANT** for teaching about sustainable development and ecology, however as a **SINGLE-PLAYER** game that has an estimated eight-hour **DURATION** it might not be useful in most contexts. Alternatively, a moderator

led play-session could focus on a particular (and more relevant) section of the game (Figure 4).

Figure 4. Ludwig. A computer game by ovos. Screenshot retrieved from: https://ovos.at/en/projekte/knowledge-rules-the-game/.

Game facilitation

Overview

You've now considered why you want to use a serious game and perhaps selected a few games that suit your needs, but how do you build a session around a game? In order to get the most out of using serious games, you need to facilitate them within a wider session. Facilitating activities are best broken down into two categories: (1) those that occur before the game is played and (2) those that occur afterwards.

In order to support facilitating a chosen game within a session, we present three examples for both before and after play in Table 7. You can use any number or combination of activities based on your target audience, available time, and resources.

Table 7. Ways of facilitating a game.

Before play activities	After play activities
Providing Context. Depending on the target audience, you might be unable to simply present the game without first providing some additional context or information about your goals or topic of choice. It is best to consider what information do the players need in order to get the most out of the play session.	***Reflective Exercises.*** After playing the game, it is important to allow space for reflection to thoughtfully consider what they've been taught. Some reflective exercises might include sharing one key takeaway from the game, writing a brief summary of their experience, or discussing how the game's lesson might apply to their own lives.
Focused Discussions. A focused discussion is a fantastic opportunity to invite the participants to share their own experiences linked to specific areas of the topic. A discussion activity could allow for an interesting comparison in how the player(s) felt before and after playing through the game.	***Establishing Next Steps.*** If your intended goal involves a change in behaviour, encouraging the player(s) to list the next steps allows them to see how the game's lesson applies to their day-to-day lives. You should emphasise that each step should be actionable and achievable, to increase the chances of being adopted in practice.
Priming Activities. Priming is a technique to influence the behaviour or thoughts of someone at a later date. For example, making a presentation that lists the benefits of recycling just before the player(s) play a game about recycling, might influence the player to be more pro-recycling in their in-game actions. When considering a priming activity, you should keep in mind what you are priming the player(s) to do and ensure it aligns with the core message of the game you're using.	***Repeated Play.*** Repeated play is encouraging the player to revisit the game, perhaps after being provided with new information. Inserting a break between attempts, allows for a short debrief of what happened, guiding the player to make more measured or informed choices in later attempts. This technique is particularly effective for games with clearer success/failure states, where if the player is unsuccessful in their first attempt they can apply the new information to help them succeed.

One thing to consider when attempting to facilitate a game is what level of facilitation does the game require. Certain games will need more facilitating than others, for example much like how some social games encourage the use of a moderator whereas digital games are typically more standalone experiences. The last thing you want is for any of the activities to undermine or present conflicting information to what the game is

attempting to present. In particular, if a game experience hinges around a big reveal, the facilitation should never reveal that before play, but can explore or reflect on it afterwards.

Even within each activity, there are dozens of different approaches that can be tailored to best suit the goals of play, resources available, or your distinct presentation style. In addition, certain players are more receptive to different kinds of activities, so utilising a range is often encouraged. Overall, keep in mind what message you want the players to leave with, using how the game is facilitated to enhance the play experience as much as possible.

Example scenario: Facilitating Earth Opoly

Let's say that a teacher wishes to use Earth Opoly within a classroom setting as a means to teach younger students of all the different ways to care for the planet. The teacher is worried that if the students begin playing immediately then they might lose the reason why they're playing. In order to correct this, they include a **PRIMING ACTIVITY** to give the students explicit areas to focus on. Once the game is over, they can have a **REFLECTIVE EXERCISE** where students can list the different ways the Earth can be cared for.

Task

With one or multiple of the selected games, consider which kinds of before and after play activities would best support your or the game's core message. Use the following "Questions to consider" to support you.

Questions to consider

- What information and context might the player(s) need that isn't provided by the game?
    - Is there any information that would be more impactful if revealed after play?
- How might you encourage the player(s) to consider or discuss their own experiences before play?
- How can the player(s) be primed to think about a topic a certain way?
    - What effect might this have on how they play the game?
- What topics in the game might need more prompting for player(s) to reflect on?
- Do you desire for the player(s) to leave with actionable next steps?
    - How might you encourage the players to consider what to do next?

- Would the player's benefit from replaying the game (perhaps now with new insights or understanding)?

Example games

Never Alone (Kisima Ingitchuna) - Upper One Games and E-Line Media. Never Alone is a puzzle platformer that authentically explores the cultural folklore of the Iñupiat Native Alaskan people and their ties to the world around them. Before playing the game, it might be beneficial for the players to be **PROVIDED CONTEXT** around how Never Alone tells the lived-experience of the Alaskan Native community. Each shared vignette is an opportunity for the player to **REFLECT** on how their experiences differ (Figure 5).

Figure 5. Never Alone (Kisima Ingitchuna). A computer game by Upper One Games. Screenshot retrieved from: http://neveralonegame.com/game/.

The Climate Game - The Financial Times & Infosys. The Climate Game is a strategy game in which the player must attempt to bring the world's emissions down to net zero by the year 2050. Each round presents a number of choices and resources to balance (e.g., effort, CO_2, and years). You could conduct a **PRIMING ACTIVITY** to reinforce how harmful high global emissions are, while foreshadowing some of the ways to reduce it. Alternatively, **REPEATED PLAY** would allow the player to improve their overall score and potentially reach net zero emissions (Figure 6).

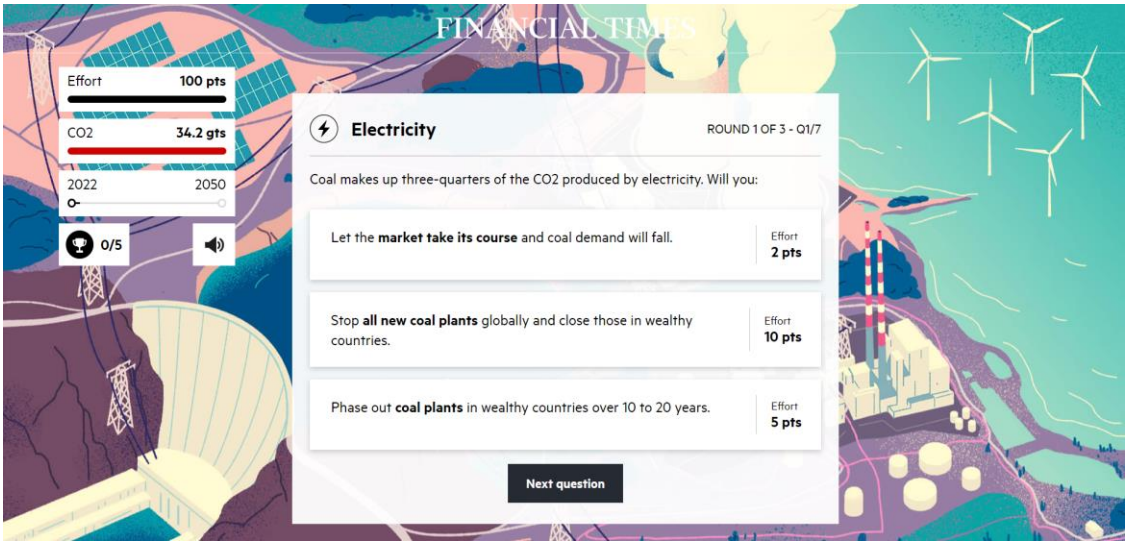


Figure 6. The Climate Game. A web-based game by the Financial Times. Screenshot retrieved from: https://ig.ft.com/climate-game/.

User checklist

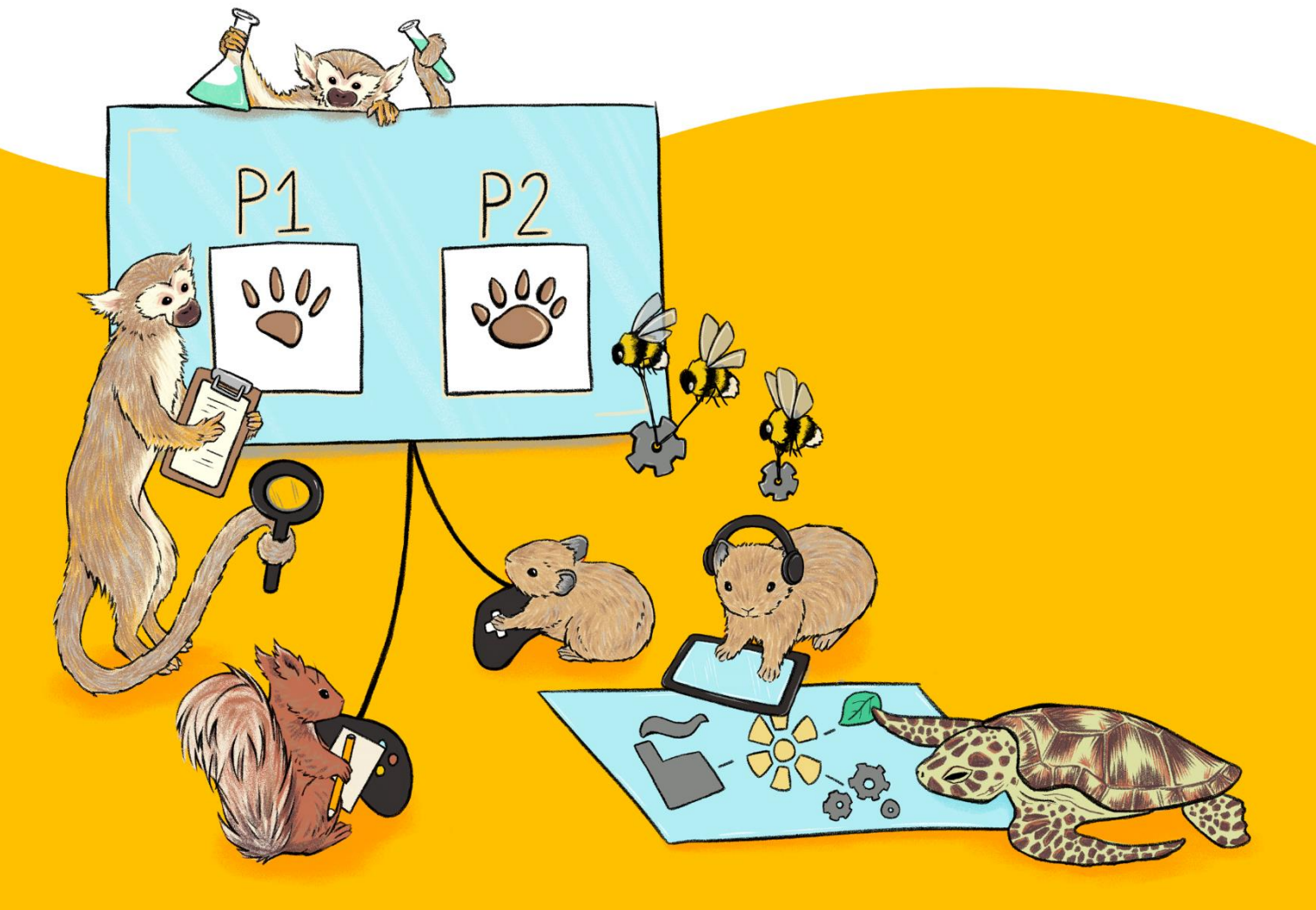
Table 8. A checklist for user tasks.

TASK	DONE
Review the four suggested goals of play for a serious game, and consider which is most appropriate for you.	
Find one game and play it (even if you have to control multiple players). After playing it, review the game's relevance, number of players, duration and complexity for suiting your goals of play.	
With one or multiple of the selected games, consider which kinds of before and after play activities would best support your or the game's core message.	

Designing Serious Games

How do you design a serious game? The Serious Games Cookbook hopes to provide researchers, practitioners, and moderators who want to be creating games with the means to begin designing their own games. The Designer section focuses on supporting the design of a serious game's content, themes, and mechanics, alongside strategies to consider the player's experience and improve the game's ability to shift attitudes.

It is worth nothing that one of the most effective ways to understand the design of serious games is to simply play them. If you had followed on from the Users' considerations then you should be well equipped with the knowledge of how serious games can be used to begin designing your own. Before reading much further, ensure you've had enough time to play/use a range of serious games (the more the better!).



Process of designing a serious game

For serious games, design involves considering the aesthetics, themes, content, and mechanics of a game for a specific purpose (e.g., such as education, problem solving, raising awareness, or research). Broadly speaking, there are five steps to designing a serious game:

1. ***Establish a goal.*** Before designing anything, you need to have a clear idea of what you want your players to leave the experience with, or how exactly the game can be used for (guidance for this step is included in the Users: Goals of Play section).
2. ***Clarify content & themes.*** With an idea of what you want the game to achieve, you can consider what the content and themes of the game might include (e.g., game material, play context, theme exploration, and setting).
3. ***Prototype the mechanics.*** Come up with some prototype mechanics for your game. At first, these mechanics may involve some guesswork about what will be engaging and effective. A good approach is often to adapt mechanics from existing games. You may want to focus at first on developing a "core mechanic": an essential play activity that players perform again and again in a game (Salen and Zimmerman 2003). Try to ensure that the core mechanic embodies the game's intended message.
4. ***Playtest & refine.*** With a core mechanic prototyped, you can begin playtesting to see how players respond. Playtesting helps highlight what works and doesn't work. Occasionally the refinements are inspired by remembering the player experience or focusing how the game can better shift its player's attitudes.
5. ***Repeat until release.*** A game can be endlessly playtested and refined (if there are no time limitations), but if the playtests suggest the game successfully conveys your message then it is safe to release the game. As they say, "perfect is the enemy of good".

The following sections assume you've already established the goal (see Users: Goals of Play) or message you want your game to convey, focusing on guiding designers in (2) clarifying content & themes, (3) prototyping the mechanics, and (4) playtesting & refining.

Tooltip: Tools for Development

The Serious Games Cookbook focuses more on helping readers in designing serious games (e.g., planning of the features), rather than the technical aspects of development. There are so many different tools out there to support game development (some tailored for specific types of games), each with their own advantages or limitations. There is too much to cover in this Cookbook, however below are some game development tool suggestions as a starting point:

Tabletop. The quickest and easiest method of developing a game is physically, because you can design a game using pieces of paper and the odd token (e.g., chess piece, Lego figure, or even coins). You can find all manner of printable templates, art resources, and more online (e.g., https://boardgamedesignlab.com/tools-resources/). There are additional tools available to create digital versions of board games, allowing for remote play (e.g., https://playingcards.io/).

Twine. Twine is an open-source tool for telling interactive, nonlinear stories. Games can be developed through either a desktop app or within your browser of choice. Additionally, the games are published to HTML, allowing games to work in most browsers. Twine has an easy learning curve, and is good for creating text-only games. With a little knowledge of HTML and Javascript you can also integrate pictures. Link: https://twinery.org/.

GameMaker Studio. GameMaker is a complete development tool for making 2D games, used by indie developers, professional studios, and educators worldwide. Games can be developed using GML visual (a drag and drop visual scripting language), and published to work across systems, browsers, and game consoles. Link: https://gamemaker.io/en/gamemaker

Unity. Unity is one of the world's most popular development platforms for creating 2D and 3D multiplatform games and interactive experiences. The engine predominantly uses the C# coding language, supporting cross-platform development for mobile, desktop, and consoles. You can purchase tools and assets in the Unity Asset Store to make the learning curve less steep (e.g., so you don't have to do all the animation yourself). However, if you are new to Unity, you may find there is a lot to learn before you get anywhere near implementing your visions. So you may want to explore partnering with a developer who already has Unity skills. Link: https://unity.com/

Game content & themes

Overview

When developing a serious game, many aspects need to be considered early on. In order to support narrowing down the type of the game you want to create, we present the “four axes of game content creation”. Each axis presents a different way to approach creating a game, including:

- ***Axis of material.*** The first axis explores the differences between developing a physical or a digital game. Physical games share the benefits and familiarity of a board game, whereas digital games can reach more players and better present simulations (Table 9).
- ***Axis of play context.*** This axis asks you to consider how the game might be played, either by players individually or as part of a social context. An individual play context allows for a more tailored game experience, whereas a social game better facilitates discussion or debate (Table 10).
- ***Axis of theme exploration.*** This axis describes how the core subject or themes of your game is explored; either explicitly or abstractly. Abstract mentions leave it up to the player to interpret the connections to sustainability, whereas explicit mentions can directly point to the topic at hand (Table 11).
- ***Axis of setting.*** This axis describes the game’s setting, whether it is based entirely in reality, uses fantasy elements, or presents an entirely fantastical world. The more realistic a world is, the easier it can be for a player to relate, but a fantastical world is more approachable for exploring sensitive topics (Table 12).

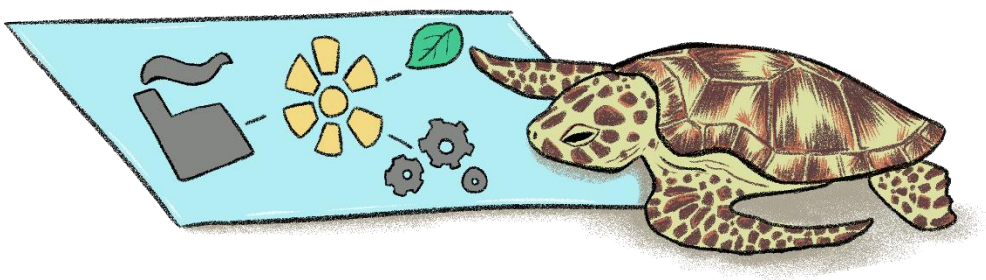


Table 9. Axis of material in the four axes of game content creation.

Physical game	Digital game
Physical games usually require the player(s) to be physically present either around a game board, deck of cards, or play space (although some physical games can also be played remotely, e.g., on Zoom). Physical games can lend themselves to a more social experience. Physical games are also generally quicker to develop, since they don't require game engines or coding. However, some physically rely on bespoke resources (e.g., bespoke tokens, cards, or game boards) which do require technical skills to produce. Other physical games may rely on more generic resources (e.g., dice, ordinary playing cards, pen and paper).	Anything played on an electronic device (e.g., a console, computer, or phone) is a digital game. Digital formats lend themselves better for simulating complex situations, and with networking capabilities allow players to share an experience despite not being within the same room. While digital games can be more accessible in a wider range of settings, the development typically requires more technical skills when compared to physical games (e.g., programming, networking, or web design).

Table 10. Axis of play context in the four axes of game content creation.

Individual	Social
Any game intended to be played by a single person in an individual context. Individual games have the benefit of allowing the player to better tailor their experience and often require far less organisation to start playing. Games as a single player experience require more from both sides (e.g., the game and player). The game needs to meet the project's goals without external guidance, while the player must remain motivated to play.	Social games are any that involve more than one player, whether that is in a competitive or collaborative context. With more people the game can encourage discussion or debate around a particular topic as part of play. Since they involve more people, social games require a little coordination/planning and may require someone to act as a moderator, especially for a large group. Plus certain social games can result in less confident or skilled players being left out.

Table 11. Axis of theme exploration in the four axes of game content creation.

Abstract themes	Explicit themes
Abstract themes allow for the goals of the game to be tackled covertly, which can place the player in a more receptive mindset to receive new or conflicting information. An obvious drawback with utilising abstract themes is that they rely on the player correctly interpreting them, meaning there is the possibility they entirely miss the message or end up leaving with a problematic understanding.	Explicit themes ensure that the player is entirely aware of what the game is about and attempting to teach. A clear theme is easier for the player to confront their feelings or reflect on their current understanding of the topic. One potential downside to an explicit approach is that the player might be resistant to attempts to persuade, resulting in believing they are uniquely immune to the negative consequences presented (Oliver et al., 2016).

Table 12. Axis of setting in the four axes of game content creation.

Realistic setting	Fantasy setting
As the name might suggest, a realistic setting presents the game world in a world identical (or very similar) to reality. A game set on Earth five years in the future would still be considered a realistic setting, being based on Earth. Players are more likely to be able to relate to a realistic setting, as they more easily draw from their own past experiences. However, if the player has no relevant experiences, it might have the opposite effect.	A fantasy setting can be anything from an unexplored planet, alternate dimensions, worlds where magic exists, or ones ruled by robots. Complicated topics can appear more approachable in a fantasy world, as the connections to real world situations are blurred. Much like using an abstract theme, a fantasy setting is easier to approach, but it has the potential to make connecting the game to real world examples more challenging for players.

It should be emphasised that each axis is not a binary choice one or another, in fact each should be considered a spectrum that can be adjusted throughout the game for effect. For example, you could design a game that requires all the players to work individually on a digital game before the game changes into a physical collaborative social task. Or maybe your game covers topics of water management using abstract themes in a fantasy world (e.g., space lava flows or wizardly magical fluids), that shift to explicitly reveal the themes while removing the fantasy elements.

Overall, how your game fits within the four axes of game content creation has a significant impact on the types of mechanics that best suit your goals and the overall player experience. The axes of game material and play context frame how the players engage with the game, whereas the axes of theme exploration and setting dictate how the underlying themes or goals of the game are presented to the player. There is no singular correct approach, as games with more abstract/fantasy settings avoids the player having a negative reaction to attempts to persuade (Knowles & Linn, 2004), whereas being more explicit with the themes allows the player to confront their own feelings on the topic or relate with their own experiences (Bopp et al., 2016). It is entirely possible that how the themes are addressed, game material, and the game's setting might need changing during development, which is always manageable if you keep the goals of the project in mind.

Tooltip: Additional Game Design Resources

While the Serious Games Cookbook provides core topics to consider, the art of game design is far too broad to cover all the aspects and intricacies, however below are some suggested further reading covering game design fundamentals:

The Art of Game Design: Book of Lenses - Jesse Schell. The Art of Game Design covers the fundamental principles of game design, providing 100+ different lenses to view a game's design along with the important questions to consider. The book is considered a cornerstone of design, helping develop better games faster.

Rules of Play: Game Design Fundamentals - Katie Salen & Eric Zimmerman. The Rules of Play present eighteen conceptual frameworks, including games as systems for information, contexts for social play, and as sites of cultural resistance. The book is written to be applicable to game scholars, developers, and interactive designers.

Persuasive Games: The Expressive Power of Video Games - Ian Bogost. Persuasive Games explores the way in which games can encourage long-term social change, in the contexts of politics, advertising, and learning (the latter being most relevant here). The book explains how games can and have been used to present arguments and ultimately persuade their players.

Building Blocks of Tabletop Game Design: An Encyclopaedia of Mechanisms - Geoffry Engelstein & Isaac Shalev. The Building Blocks of Tabletop Game Design is a compiled resource of hundreds of tabletop game mechanics, detailing how they can be used and the impact it has on gameplay. While the other books cover design skills, this book is specifically focused on inspiring the design of tabletop games.

Example scenario: Encouraging recycling in classrooms

A teacher has set a goal to develop a serious game that encourages students to take a more active role in recycling. Their school has over 300 students without any timetable activities to hold workshops or lessons on the matter. So they decide to develop a **DIGITAL GAME**, one that the students can play **INDIVIDUALLY** on their phone. They also create external incentives to increase the chances of more students playing.

As the goal is to encourage recycling at their particular school, the teacher plans to use a **REALISTIC SETTING** based on their campus with more **EXPLICIT THEMES** on the benefits of recycling and consequences of littering. Even without a clear concept of what the game is, the teacher has a better understanding of what types of game content would better suit their goal needs.

Task

Consider each of the four axes, building on the type of game you want to make, and compare how the game might change when placed on either axis side. Use the following "Questions to consider" to support you.

Questions to consider

- How do you imagine people playing your game? (e.g., at home, in class, part of a group activity)
- What resources are available to you to make a physical or digital game?
- What is the message you want to communicate about your goal?
- Which do you consider more important: approachability or relatability?
- How could your goal be explored through abstract themes?
- What is a realistic example of your goal in practice?
- How could your goal be explored in a fantasy setting?

Example games

Beyond Blue - E-Line Media & BBC Studios. Beyond Blue is a **REALISTIC**, **DIGITAL GAME**, in which the **INDIVIDUAL** player explores the earth's oceans through the eyes of a deep-sea explorer and scientist. The game focuses on replicating a real-life research project, rather than a fantastical journey like Abzu (Summers, 2018), highlighting **EXPLICITLY** what environmental issues the Earth's seas face (Figure 7).

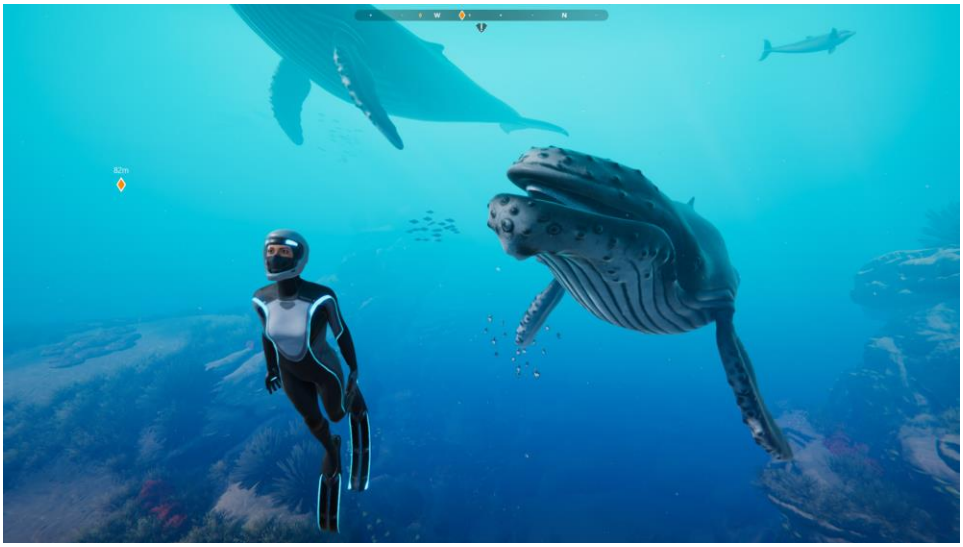


Figure 7. Beyond Blue. A computer game by E-Line Media. Screenshot retrieved from: https://www.beyondbluegame.com/.

ClimeOut - Snowflake Education. ClimeOut is a **SOCIAL** and **PHYSICAL GAME** in which the teams of players compete against each other in one of three kinds of duels: (1) Quiz: fact-based questions within a climate-related topic, (2) Glossary: duel on who is fastest at explaining climate glossary to their teammate and (3) Puzzle: duel on who is fastest at gap filling and explaining a graph, chart or a chain of events. The topic of addressing climate change is as **REALISTIC** and **EXPLICIT** as possible (Figure 8).

Figure 8. ClimeOut. A physical game by Snowflake Education. Image retrieved from: https://snowflakeeducation.com/products/climeout-climate-change-learning-package-6-game-pieces.

Mechanics is the message

Overview

Beyond establishing what the core message, themes, and content are for a serious game the next step is arguably the most important: designing the game's mechanics. A game's mechanics are the rules or systems that the player interacts with in order to play. The concept of "mechanics is the message" is an approach to designing a game where the mechanics embody the intended message of the game as much as possible (Brathwaite & Sharpe, 2010).

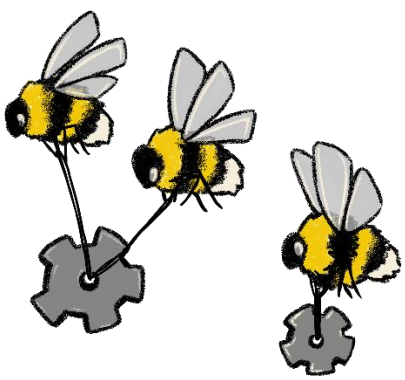
To give a simplified example, if a game had a mechanic that rewarded the player with in-game currency for each plastic bottle recycled, then the message of encouraging recycling is supported and incentivised by the mechanics in game. However, all aspects of the game need to be designed with the core message in mind, otherwise systems could be introduced that emphasise a different message (or worse the opposite). Expanding on the previous example, if the same game also awarded the players with more in-game currency to trash plastic bottles than recycle them, then instantly the core message of the game is undermined. "Ludonarrative dissonance" is a popular term for describing when a game's mechanics are seemingly at odds with the intended message or story of the game (Despain & Ash, 2016).

One way to design a mechanic to embody the message of a game is to consider either a story or system driven approach (Table 13). A story driven approach focuses on presenting a narrative to the player, whereas a systems driven approach presents a simulation where the player can experiment. Again, these approaches shouldn't be considered binary and your designs could sit in the middle of the spectrum between either end.

Generally, the player leverages the game's mechanics in order to achieve their goals. In a story driven game they make the choices that they expect will lead them to a desirable ending whereas in a systems driven game they take the actions that lead them towards an expected outcome. As mentioned earlier, extra care needs to be taken to ensure the mechanics don't inadvertently incentivise the wrong message, particularly if your game has a clearly defined win state. One solution is to consider what the "optimal" play style would be, if the optimal way to play a game about saving trees is to cut them all down then the mechanics are embodying the wrong message.

Table 13. Approaches of conveying messages.

Story driven	Systems driven
Story driven games attempt to use a highly engaging narrative experience (e.g., compelling characters, setting, or events) to present the player with the core message. Therefore, the mechanics in the game exist to support telling the story (and message by proxy). A narrative choice is an example of a story driven mechanic. The power behind a story driven approach allows the player to be placed into new experiences or view an event through the perspective of someone else.	System driven games are typically closer to simulations or sandboxes, in which the player has multiple mechanics to impact the game in different ways and how it responds is the game's "system". The benefits of a system driven approach is that the player can actively explore how the system works through experimentation. For example, a mechanic that allows players to insert dams along a river, the way in which the game's systems respond to the placement could convey if the player made a desirable or undesirable action (e.g., flooding residential areas or droughts).



Tooltip: Collaborative or Competitive?

There is far more to consider when designing the mechanics of a social or multiplayer game, in particular whether to create a collaborative or competitive experience. A collaborative game can unify the players with a common goal, whereas a competitive game puts players against one another. Each approach has its own benefits, although competitive games are far less common within the serious games space.

For example, you could raise awareness around corporate greed's impact on sustainability through a competitive game, or how small acts add up to a bigger impact in a more collaborative focused game. Below are some example mechanics which are likely to encourage collaboration or competitiveness within players:

Collaborative mechanics might include:

- The players either all win or lose the game together.
- Players have the ability to share information and resources amongst each other.
    - Or perhaps the players all share the same pool of resources.
- Actions require more than a single player in order to complete them.

Competitive mechanics might include:

- Only a single player can win the game.
- Players receive points or benefits from taking actions that negatively impact other players, such as:
    - Stealing or denying a resource from another player.
    - Directly harming the player's tokens (e.g., destroying buildings, dealing health damage)
    - Concealing information from the other players.

These mechanics are fairly abstract, since they can be applied to games broadly instead of a specific game, but you can see the way in which they serve as foundational principles that guide game design. There is also the possibility for a combined collaborative and competitive game, perhaps one in which teams of players compete, or a game begins competitively focused before the systems change to encourage collaboration.

What if you can't think of a core mechanic? Look to other games for inspiration. For example, think of the card game Blackjack. It uses a "push your luck" mechanic that is actually common in a lot of games. If you have been dealt a hand worth 16 or 17, do you stick with it, or risk taking another card — losing everything if you go over 21? How might

you adapt this to a climate themed game? Perhaps “pushing your luck” could be waiting for a climate technology to fall further in price before adopting it. In this way, you can start with some simple mechanics, and adapt and connect them to create stimulating games with strategic depth.

Overall, the mechanics of a game is what sets the medium of games apart from television, films, or books, which is why they should be leveraged as much as possible to convey your message. For more complicated games (e.g., those with multiple interconnected mechanics) taking the time to ensure each suitably feeds into the core message becomes all the more important.

Example scenario: Presenting the life of a climate change activist

Somebody wants to create a game that informs the players about what it means to be a climate change activist, they’ve already settled on the idea for a **DIGITAL, INDIVIDUAL** game that is **EXPLICIT** about its themes in a **REALISTIC** world.

They consider that a strictly story driven approach might put you in the shoes of the activist, where the mechanics involve making the choices they would on a day-to-day basis. The activist could be a named character, shifting the game more towards the interactive fiction genre of games.

Alternatively, a system driven approach might represent the experiences of the activist as a map of a location where resources like money and outreach need to be leveraged to meet certain goals. The mechanics could involve planning and strategising outreach events, leaning into the more tactical genres of games.

Task

Design the core mechanic for your game, focusing on what the player does and how it embodies the message you want to present. Use the following “Questions to consider” to support you.

Questions to consider

- Are there existing games whose mechanics you can borrow and adapt?
- How might you create a mechanic that captures the message of your goal?
- What can the mechanic teach the player about your goal?
- What does the mechanic incentivise the player to do? Is this desirable?
- How could the mechanic be expanded to allow for a story driven experience? Or perhaps a system driven one?

Example games

New Shores: A Game for Democracy - Centre for Systems Solutions. New Shores is a multiplayer game that wants to convey how harvesting the island's resources can support economic or social growth, however to do so without limitation would upset the environmental balance. To avoid an increasing number of natural disasters the players can use democratic efforts to balance growth against environmental dangers. Mechanically the game takes a **SYSTEMS DRIVEN** approach, as resources like coal have more value, but negatively impact the island's health, while the players can share resources, impose sanctions on players, and communicate to establish their own democracy (Figure 9).

Figure 9. New Shores: A Game for Democracy. A web-based game by the Centre for Systems Solutions (https://newshores.crs.org.pl/). Screenshot retrieved from: https://games4sustainability.org/gamepedia/new-shores/

Lumino City - State of Play & Noodlecake Studios. Lumino City is a puzzle platformer in which the player navigates through a world crafted out of card, paper, small lights, and motors. The core of the game is a **STORY DRIVEN** experience, but each of the game's mechanics embody a message of utilising renewable technology by having each puzzle involve powering up a location using sustainable practices. The core message is further supported with a "handy manual" that provides information about the applications of renewable energy (Figure 10).

Figure 10. Lumino City. A computer game by State of Play. Screenshot retrieved from: https://www.stateofplaygames.com/luminocity

Remember the player

Overview

Up until now, we've focused on all the different design elements of a game, but you should never lose focus on the player. Ultimately, it is the player who will be engaging with your game and every design decision impacts their experience. There is an approach to designing games called player-centred design, which acknowledges that a game is to be played and tailors the design to best suit the player (Kumar et al., 2020).

There is no replacement for direct feedback from people playtesting your game, however we present four areas of the player experience to focus on (Table 14). Each focus area considers what the player might be able to do in the game, how they might feel during play, or areas that when underserved lead to a less-enjoyable player experience.

Table 14. Player focus areas.

Player agency	**Player relatability**
Player agency is how much the player is able to impact the game through their choices or actions. The power that games have is to allow players agency during complicated or challenging situations, letting them make decisions and reflect on their consequences (Khaled, 2018). When the player feels that they have no agency it can be harder for them to connect with the experience, given they can't meaningfully change it.	Relatability is how much the player is able to connect their own experiences with what the game is presenting (Ryan et al, 2006). Strong relatability builds a better personal resonance, allowing the game to feel more meaningful. The relatability of an experience can be improved when the player's past experiences (or similar events) are presented in game, which encourages empathy or shared common ground.
Player feedback	**Player enjoyment**
Player feedback has two meanings. The first is that the game routinely provides the player with feedback on their actions (e.g., a shifting bar, increase in resources, or a character response). Without feedback how can the player be expected to adapt their playstyle or learn to do the correct things? The second meaning is to literally gather player feedback, show your designs or early game prototypes to potential players and listen to what they like/dislike.	We should want the player to enjoy the games we create. Part of using the medium of games is to encourage learning while also having fun. But keep in mind that enjoyment has many flavours, especially when dealing with challenging subject matters like climate change. If the player finds zero enjoyment in the game they're playing, then they're far less likely to take any message away with them.

Both the areas of player agency and feedback are connected to the concept of a "meaningful choice". Players believe a game has a meaningful choice if they include one of three core elements; moral, consequential, and being social (involving other characters) (Iten, et al., 2017). Moral choices involve the player weighing up their own personal beliefs or values in a dilemma of some kind. The consequential element ties to the feedback, in which the player can see how their actions impacted the game.

The social element of meaningful choices can connect to the relatability focus, where a choice is more meaningful if the player can actively relate or empathise with the characters involved. Empathetic design is another approach that focuses on using the power of identification to help players relate to situations, which include all four of the player focus areas. Farber & Schrier (2017) summarise the limits and strengths of using digital games as "empathy machines" and provide a list of recommendations for game designers (see Farber & Schrier 2017 for the full list).

When designing any game, it can be easy to get caught up in creating the mechanics or focusing on the message of the game and in doing so forget the player at the end of it all. Hopefully we have instilled the importance of remembering the player, as well as providing the means to view how each design choice might impact their overall experience.

Tooltip: Gathering Player Feedback

The importance of player testing and feedback cannot be overstated. Whenever you have a playable version of the game or make substantial changes to its design would be a perfect time to try and gather player feedback. There are plenty of different types of feedback, which are better suited for being gathered at different stages of development. Some types of gathering player feedback include:

Premise Feedback. Explaining the game's premise and mechanics to potential players to hear their thoughts. This early type of feedback can let you know if the concept is at least exciting or sounds engaging to your intended audience.

Internal Feedback. Gathering other members of the development team, friends, or family to playtest the game. This should help you get areas of your game that are confusing, enjoyable, or currently don't work as intended.

Playtest Feedback. Approaching the target audience to experiment with a paper/early prototype of the game. Listen and watch how the players engage, supporting them when necessary, and asking what they liked/disliked.

Blind Playtest. Playtest the game by providing a copy to your intended audience, letting them use it with as little external guidance as possible. A blind playtest best simulates how your game would be used in practice, which should typically work without any designers present.

To ensure that the player's experience is taken into account throughout the design process, conducting playtests with consideration of playtesters' feedback becomes a crucial step. Games are complex systems, and there is no way to predict for sure how a game will run except by actually testing it. Simple rules can give rise to surprisingly complex gameplay. And besides, players are endlessly imaginative: they may invent strategies that you never would have dreamed of, or interpret rules in strange ways that seem logical to them.

There are many different kinds of playtest, and many kinds of feedback (see also Tooltip: Gathering Player Feedback). You might play the whole game from start to finish, or focus on one or two phases. You might separate out a particular subsystem or aspect of the game. You might play the game "properly" with the right number of players, or you might play it with fewer than the intended number of players, and/or leaving out some aspects of the game so that you can focus on others. All these activities can generate useful knowledge that will inform the next iteration of the game.

It is good practice to set up a goal (or goals) for each playtest session. Goals can be loose or specific, for example:

- "I'm just going to play the game as a whole and see what happens. I'm excited and I want to know what it feels like. I am going to be a player myself. I'm not going to worry about recording the playtest or taking any notes on this occasion."
- "I want to know if the rules are clear enough. I am going to invite some playertesters to play, and I will observe silently for at least the first ten minutes, without giving them any hints or corrections. I will take some notes, but I think the players will feel more relaxed if I don't record them."
- "I want to test the mechanics for direct action. I think the best way to do this is play the game through start to finish, but whenever the Environmentalist player uses the direct-action move, we will run through it a few times, rerolling the dice, and trying out all the different Oil Company responses."
- "I am playtesting the inventory subsystem of my digital game. I am going to add a lot of temporary items to the game, so that I can do this more quickly."

However, you can't always do all the playtesting you would ideally like to do. For example, what if you are a solo designer, creating an analogue game for a large group of players, on a short timeframe? Here there are workarounds you can use, for example:

- "Playtest" aspects of the game in your head, by carefully imagining what each player might do.
- Base your game on an existing game, to benefit from the playtesting already baked into its mechanics.
- Adjust the game on the fly if something isn't working. If you do this, take care to manage expectations, so that the experience feels like an exciting, collaborative experiment. If players don't see the purpose of rule changes, they may feel they are simply unfair.
- Whatever happens, remember to have fun yourself! Failure is part of making games as well as playing games. It can be an opportunity to learn and to laugh.

Playtester feedback is valuable, and you should always listen to it carefully and take it seriously. But in the end, don't feel you *have to* incorporate every suggestion you receive. There will be bad suggestions as well as good ones. There may also be suggestions that are good in themselves, but that would develop the game away from the goals you are trying to achieve. You can always try probing the playtesters to better understand the source of their dissatisfaction (or the potential that they sense in the game), and think about alternative ways of addressing it.

Example scenario: Experimenting with increasing emission's impact on climate

A technical developer has been tasked with developing a game that lets its players (those within government) experiment with what impact rising global emissions have. They decide to make a **SYSTEMS DRIVEN**, **SOCIAL BOARD GAME**, set within the **REALISTIC** world with very **EXPLICIT** themes of climate change.

In the current version of the game, at the end of each turn the global emissions continue to rise and impact the entire game board. However, the player has no way of slowing the increase and from what actions the player can make provides no clear **FEEDBACK** on what that means, resulting in a lack of **AGENCY**. One solution is to have a physical tracker of the total global emissions on the board which can increase or lower based on the game state, combined with letting the player take actions (e.g., sacrificing cards or resources, or some other mechanic) to move the emissions tracker down, providing immediate **AGENCY** and **FEEDBACK** of those choices.

Task

Imagine you are playing the completed version of your game idea, consider how the current design impacts your sense of agency, relatability, feedback provided or overall enjoyment during play. Use the following "Questions to consider" to support you.

Questions to consider

- How does your design provide the player a full sense of agency?
    - Can the player make meaningful decisions?
    - Can the agency be restricted for effect? Should it?
- What elements of your design allow the player to relate to the world, characters, or challenges?
    - How might you let the player insert their own experiences?
- How does your design provide the player with feedback on their actions?

- How does your design let the player enjoy the game?
    - Is that enjoyment more playful or thought provoking?
- What do you hope to understand better after this playtest?
- What is your role during the playtest?
- How do you capture useful information from the playtest?
- Is the game engaging for the players?
    - Are the players having fun?
    - Are the players engaged in other ways?
    - If there is a winner, how soon does the winner become obvious?
- When I fix this problem, what else will it affect?

Example games

Fate of the World - Red Redemption. Fate of the World is a **SYSTEMS DRIVEN** turn-based strategy game in which the player manages the global needs versus protecting the Earth's climate. Every few turns the player is presented with dynamic scenarios to respond to. The player has **AGENCY** to choose from a range of options (presented as cards) and then is provided with **FEEDBACK** on how those choices impacted population, climate, power, etc. (Figure 11).

Figure 11. Fate of the World. A computer game by Red Redemption. Screenshot retrieved from: https://store.steampowered.com/app/80200/Fate_of_the_World/

Plasticity - Plasticity Games. Plasticity is a **STORY DRIVEN** puzzle-platformer set within a plastic-covered world. The game focuses around an emotional journey of leaving home, which most can **RELATE** to in one way or another. But as the game progresses the player's **AGENCY** to make meaningful choices change both the gameplay and world (providing **FEEDBACK**) (Figure 12).

Figure 12. Plasticity. A computer game by Plasticity Games. Screenshot retrieved from: https://store.steampowered.com/app/1069360/Plasticity/.

Strategies for shifting attitudes

Overview

At this stage, you should have a solid idea for what message your game intends to deliver, the mechanics to support that message, and the approach of keeping the player's experience at the forefront of your mind. What's next? We wanted to provide some strategies to bolster the chances of your player leaving your game with a shifted attitude towards your goals.

Researchers are particularly interested in finding strategies to shifting people's attitudes towards more prosocial behaviour, so there are a considerable number of different (and sometimes conflicting) approaches. In order to support you in the design of your game, we've narrowed down the strategies to four (Table 15). When included in your game, each strategy further improves the chances of the player leaving the game with a new perspective or shifted attitude.

Table 15. Strategies for shifting attitudes.

Intermixing content	**Questions over answers**
Much like how a more **ABSTRACT** theme or **FANTASY** setting can make a topic more approachable, so too can including the core message alongside off-message content. In a game, this might be represented as having moments of gameplay intermixed with information presented via dialogue or visuals.	When it comes to shifting attitudes, one of the most important aspects is allowing the player to reflect on the message being presented. It can be more effective to raise questions about your goal and encourage the player to be reflective, self-aware, and critical of what they've been told.
Roleplay	**Repetition**
Roleplaying is the act of performing as part of a person or character. When a game encourages the player to roleplay as someone else, there is a chance for their attitudes to shift as they experience a situation from the perspective of someone else. Seeing and understanding this contrasting perspective can prompt internal reflection or inform the player on topics they hadn't considered. You don't even need to roleplay as a specific person, but perhaps an occupation (e.g., scientist, a world leader, or conservationist).	Any approach to shifting a player's attitude is only supported by a repetition of the core message (Devine, 1989). In some games revisiting the message can be challenging, but when combined with the **INTERMIXING CONTENT** strategy, each time the player returns to on-message content is an example of repetition. There is a fine balance to meet, because too much repetition can come across as overbearing or feel boring for the player. The core message should be repeated in a multitude of different ways (e.g., mechanics or info).

The strategies suggested are either inspired by Khaled's guidance for reflective game design (Khaled, 2018) or Kaufman and Flanagan's work on "embedded design" (Kaufman & Flanagan, 2015). Reflective game design intends to encourage attitudes change by allowing the player to explore possibilities, the consequences, and ideally reflect on their behaviour. Embedded design, as the name might suggest, focuses on ensuring the core message of a persuasive game is embodied throughout the game (which we presented within the Mechanics is the Message consideration). These strategies were highlighted because they were considered to change attitudes using games specifically, rather than general approaches.

In order to meet climate goals, for example, behaviour change is needed in areas such as transport, consumption, energy use and diet. Research shows that information alone is not enough to drive behaviour change (House of Lords 2022). Some research suggests that persuasion is most effective when it is self-persuasion, taking place after behaviour has already begun to shift (De Meyer et al. 2020). This creates a bit of a paradox: how can behaviour shift, if people aren't yet persuaded that it is necessary? The answer is to ensure that people are given the time, space, and resources to try out more sustainable behaviours, and that disincentives are removed. Serious games can also play a role in catalysing behaviour change. They can provide opportunities to test out new behaviours in a playful way, or with altered stakes or incentives. After a play session, players can reflect on the extent to which low carbon behaviours can be adopted in their everyday lives, and if not, what blockers need to be removed.

Any or all of these strategies can be used to support the core mechanic and message of your game, whether it is through having a **SYSTEMS DRIVEN** game that allows players to experiment and ask questions or a **STORY DRIVEN** game that allows the player to roleplay as someone else. By making slight adjustments to the flow of gameplay or how the message is delivered, you can improve the chances of player's leaving with a shifted attitude.

Example scenario: Reviewing Example Games

In order to see how these strategies might be applied in practice, lets take all the previous example scenarios and consider how they might've already used one or more of the strategies:

- ***Encouraging recycling in classrooms***. Even without a clear game idea, the teacher could design the digital game to include information about the school's recycling resources **INTERMIXED** with a minigame of sorting recycling. Each time the player completes a game, the core message can be **REPEATED.**
- ***Presenting the life of a climate change activist***. Whether it is a **STORY DRIVEN** or **SYSTEM DRIVEN** game, both actively involve the player **ROLEPLAYING** as a climate change activist. Both styles of game encourage the player to explore possibilities without providing a clear answer on the best way to be an activist, prompting more **QUESTIONS OVER ANSWERS**.
- ***Experimenting with increasing emission's impact on climate***. After making the changes to improve the player's experience, the game involves a little **ROLEPLAYING** as the player is someone tasked with monitoring or reducing global emissions. Seeing the impact of raising and lowering global emissions might involve a **REPETITIVE** revisiting of the game's message, but that depends on how consequential increasing emissions is on the game state.

Task

Review the four strategies and consider if your game already features one or more of the approaches. If not, how can the game idea be adapted to include them? Use the following “Questions to consider” to support you.

Questions to consider

- How might you include the on-message content alongside off-message content?
    - What could the off-message content look like?
- What are some desirable questions you want the player to ask?
    - How might the player seek to explore those questions in game?
    - How could you help the player accept that it is okay to not always have an answer?
- Does your game support the player roleplaying as a character?
    - How might the character’s perspective differ from the player’s?
- What are some subtle and explicit ways to repeat the message of the game?
    - How might you repeat the message without it feeling overly repetitive?

Example games

Daybreak - Matt Leacock and Matteo Menapace. Daybreak is a collaborative game about stopping climate change through decarbonising the world. Each player takes control of one of four world powers, effectively **ROLEPLAYING** as those in charge of reducing the world’s carbon emissions. Everything about the game **REPEATS** the core message of how carbon emissions are harmful to the environment, with the increasing intensity of natural disasters as the temperature increases (Figure 13).

Figure 13. Daybreak. A physical game by Leacock, M & Menapace, M. Image retrieved from: https://www.dicebreaker.com/games/climate-crisis/news/daybreak-name-change.

Eco - Strange Loop Games. Eco is an online multiplayer survival game in which the world the players inhabit has a meteor approaching. The core gameplay involves the player gathering resources (e.g., cutting trees or mining) to build structures, with the surrounding ecosystem reacting to their actions. As the game progresses, the player can monitor the impact actions are having on their world and set laws to prevent harmful practices. The game raises **QUESTIONS OVER ANSWERS**, but simply stating the problem and letting the player ask how to solve it, combined with closely monitoring the ecological health **REPEATEDLY INTERMIXED** with the core gameplay loop of gathering or building (Figure 14).

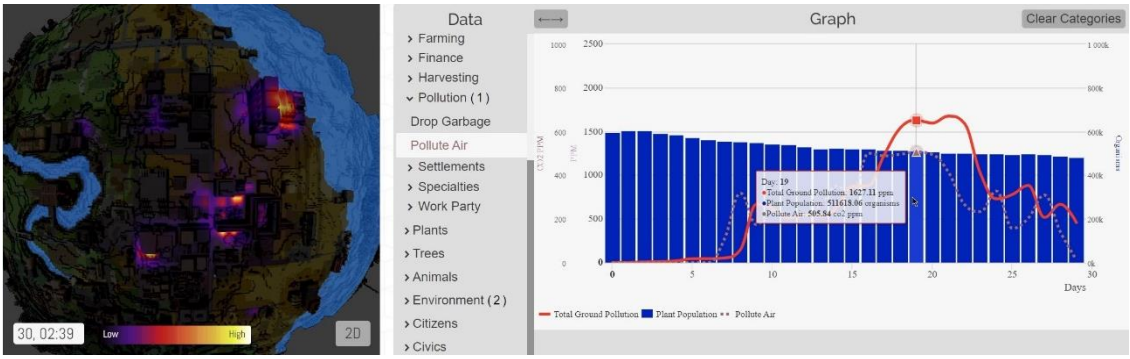


Figure 14. Eco. A computer game by Strange Loop Games. Screenshot retrieved from: https://store.steampowered.com/app/382310/Eco/.

Designer checklist

Table 16. A checklist for designer tasks.

TASK	DONE
Consider each of the four Axes of Game Content Creation, building on the type of game you want to make, and compare how the game might change when placed on either axis side.	
Design the core mechanic for your game, focusing on what the player does and how it embodies the message you want to present.	
Imagine you are playing the completed version of your game idea, consider how the current design impacts your sense of agency, relatability, feedback provided or overall enjoyment during play.	
Review the four Strategies of Shifting Attitudes and consider if your game already features one or more of the approaches. If not, how can the game idea be adapted to include them?	

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Notes

GAMENGAGE

ISBN (ebook): 978-1-911675-13-6