Game Production: serious games (design)

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1. Serious games
2. Design Principles
3. Design / assessment frameworks
1. Serious games

Starting with an example
1. Serious games

Why serious games? Check out the industry!

<table>
<thead>
<tr>
<th>Valuechain</th>
<th>Turnover (in mln €)</th>
<th>Jobs</th>
<th>#Companies</th>
<th>Jobs per company</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAME STUDIO</td>
<td>80 - 100</td>
<td>1590</td>
<td>250</td>
<td>6.2</td>
</tr>
<tr>
<td>GAME STUDIO / PUBLISHER</td>
<td>20 - 30</td>
<td>360</td>
<td>5</td>
<td>72</td>
</tr>
<tr>
<td>PUBLISHER</td>
<td>20 - 30</td>
<td>380</td>
<td>30</td>
<td>12.7</td>
</tr>
<tr>
<td>DISTRIBUTOR</td>
<td>10 - 20</td>
<td>200</td>
<td>10</td>
<td>16.8</td>
</tr>
<tr>
<td>TECHNOLOGY SUPPLIER</td>
<td>15 - 30</td>
<td>340</td>
<td>10</td>
<td>38.0</td>
</tr>
<tr>
<td>SERVICE PROVIDER</td>
<td>5 - 15</td>
<td>130</td>
<td>25</td>
<td>5.1</td>
</tr>
<tr>
<td>GAMING</td>
<td>150 - 225</td>
<td>3000</td>
<td>330</td>
<td>9.1</td>
</tr>
</tbody>
</table>

Source: TNO, data from CONTROL MAGAZINE/LISA/CBS research

57% of Dutch game companies involved in Applied Gaming

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entertainment</td>
<td>38%</td>
</tr>
<tr>
<td>Applied</td>
<td>44%</td>
</tr>
<tr>
<td>Both</td>
<td>13%</td>
</tr>
<tr>
<td>unknown</td>
<td>6%</td>
</tr>
</tbody>
</table>

Source: TNO, data from CONTROL/LISA/CBS research
1. Serious games

What are serious games?

1. “[any] computerized game whose chief mission is not entertainment [including] entertainment games which can be reapplied to a different mission other than entertainment” (Sawyer, 2004)

2. “games that do not have entertainment, enjoyment, or fun as their primary purpose”.... this is not to say that serious games are not entertaining, enjoyable, or fun, ..... (Michael & Chen, 2006)

3. “a mental contest, [played with a computer] in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives.“ (Zyda, 2005)
1. Serious games

A plethora of terms

- The serious games domain is characterized by the use of many, related yet not equivalent terms
  - Applied games
  - Advergames
  - Edutainment
  - Game-based learning
  - Simulation games
  - Persuasive games
  - Organizational-Dynamic games
  - Business simulation games
1. Serious games

Domains: marketing / advergames

- Purpose: integrate advertising into video games to advertise products, organizations, opinions, ...

KLM Aviation Empire, 2013

In-game advertising!

FIFA International Soccer, 1993
1. Serious games

Domains: edutainment and game-based learning

- Purpose: educate/learning as well as entertain
  - Often for kids, but not only!

[Image: Timez Attack (Big Brainz)]

[Image: Rocksmith]

https://www.youtube.com/watch?v=sAXCNvTRAx0
1. Serious games

Domains: simulation

- Purpose: acquisition or exercise of different skills
- Simulated environment: the variables in the environment are transposed to the game environment

Flightgear (open source)

X-Plane
1. Serious games

Domains: awareness

- Purpose: create awareness on reality through games
  - Communicate opinions / viewpoints

NarcoGuerra: Mexican drug wars

Filosofighters

https://www.youtube.com/watch?v=txLIpS5bJ5U
1. Serious games

Domains: business

- Purpose: to deliver knowledge about management principles, economics, ...
1. Serious games

Domains: healthcare

- Purpose: psychological therapy, cognitive training, emotional training, also exercise (exergaming)
- For whom?
  - Patients
  - Doctors
  - Relatives
Outline

Lecture contents

1. Serious games
2. Design principles
3. Design / assessment frameworks
2. Design principles

Overview

- All the principles from game design still apply
  - A serious game is still a game!
- The difference is how to encode the non-entertainment *purpose* into the game
- What is the purpose? It depends on the type of game
  - Educational game → Contents are learned
  - Advergame → persuasion, brand recall
  - Exergame → fitness
  - Pain relief game → distraction from painful surgery
  - Awareness game → knowledge is obtained about...
  - ...
2. Design principles

Focus on educational games in this lecture

- Where does one start from?
  - Understand the **intended learning outcomes**
    - *Intended*, by the instructor
    - *Learning*, something has to be apprehended
    - *Outcomes*, to indicate the expected result
2. Design principles

Learning outcomes, Bloom’s revised taxonomy

- **Learning outcome** = a statement of a learning objective contains a verb (an action) and an object (usually a noun)
  - The **verb** generally refers to [actions associated with] the intended **cognitive process**
  - The **object** generally describes the **knowledge** students are expected to acquire or construct

- **Examples:**
  - Students will be able to **exemplify** all the **formal game elements**
  - Students will be able to **recognize** if a **software system is a game**

2. Design principles

Learning outcomes, Bloom’s revised taxonomy

- Two dimensions: knowledge and cognitive process
- Scale of learning levels
2. Design principles

Learning outcomes, the **Knowledge Dimension**

- What knowledge is being imparted?
  - Not all knowledge is the same

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**The knowledge dimension — major types and subtypes**

<table>
<thead>
<tr>
<th>concrete knowledge</th>
<th>abstract knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>factual</td>
<td>conceptual</td>
</tr>
<tr>
<td>knowledge of terminology</td>
<td>knowledge of classifications and categories</td>
</tr>
<tr>
<td>knowledge of specific details and elements</td>
<td>knowledge of principles and generalizations</td>
</tr>
<tr>
<td>knowledge of theories, models, and structures</td>
<td>knowledge of criteria for determining when to use appropriate procedures</td>
</tr>
</tbody>
</table>

Adapted from Anderson and Krathwohl, 2001, p. 46.
# 2. Design principles

**Learning outcomes, the Cognitive Process Dimension**

<table>
<thead>
<tr>
<th>lower order thinking skills</th>
<th>higher order thinking skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>remember</strong></td>
<td></td>
</tr>
<tr>
<td>recognizing (identifying)</td>
<td></td>
</tr>
<tr>
<td>recalling (retrieving)</td>
<td></td>
</tr>
<tr>
<td><strong>understand</strong></td>
<td></td>
</tr>
<tr>
<td>interpreting (clarifying, paraphrasing, representing, translating)</td>
<td></td>
</tr>
<tr>
<td>exemplifying (illustrating, instantiating)</td>
<td></td>
</tr>
<tr>
<td>classifying (categorizing, subsuming)</td>
<td></td>
</tr>
<tr>
<td>summarizing (abstracting, generalizing)</td>
<td></td>
</tr>
<tr>
<td>inferring (concluding, extrapolating, interpolating, predicting)</td>
<td></td>
</tr>
<tr>
<td><strong>apply</strong></td>
<td></td>
</tr>
<tr>
<td>comparing (contrasting, mapping, matching)</td>
<td></td>
</tr>
<tr>
<td>explaining (constructing models)</td>
<td></td>
</tr>
<tr>
<td>executing (carrying out)</td>
<td></td>
</tr>
<tr>
<td>implementing (using)</td>
<td></td>
</tr>
<tr>
<td><strong>analyze</strong></td>
<td></td>
</tr>
<tr>
<td>differentiating (discriminating, distinguishing, focusing, selecting)</td>
<td></td>
</tr>
<tr>
<td>organizing (finding coherence, integrating, outlining, parsing, structuring)</td>
<td></td>
</tr>
<tr>
<td>attributing (deconstructing)</td>
<td></td>
</tr>
<tr>
<td><strong>evaluate</strong></td>
<td></td>
</tr>
<tr>
<td>checking (coordinating, detecting, monitoring, testing)</td>
<td></td>
</tr>
<tr>
<td><strong>create</strong></td>
<td></td>
</tr>
<tr>
<td>generating (hypothesizing)</td>
<td></td>
</tr>
<tr>
<td>planning (designing)</td>
<td></td>
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<tr>
<td>producing (construct)</td>
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</tbody>
</table>

Adapted from Anderson and Krathwohl, 2001, pp. 67–68.
2. Design principles

Learning outcomes, exemplified

- Consider a serious game about renewable energy
  - Think of the differences in terms of serious game design

- To list the X main types of renewable energy sources
- To recognize if a power plant uses renewable energy
- To illustrate renewable energy sources with practical examples
- To criticize and compare different renewable energy sources
- To construct a combination of renewable energy sources for a given sample scenario
- ...
## 2. Design principles

**Learning outcomes and game objectives/goals**

- Learning outcomes are not game objectives.
- The challenge is all about translating **learning outcomes** into **game objectives**.
- **Corollary**: we also need to translate the **learning process** into the **game mechanics**.

- A direct mapping may exist
  - “To recognize if a power plant uses renewable energy” could be mapped to a mission in the game.

- But sometimes direct mappings would be inadequate
  - “To repeat the X main types of renewable energy sources” would make the game quite boring!
2. Design principles

Employing patterns [Huynh-Kim-Bang et al., 2010]

- Design patterns come from software engineering
- Defined as “a general reusable solution to a commonly occurring problem within a given context”
- Example: model-view controller for developing software with an user interface
2. Design principles

Patterns [Huynh-Kim-Bang et al., 2010]

- Based on the analysis of 20 serious games about basic life support training

- **Pattern 1: Game-based learning blend**
  - **Context**: users must learn more than a simple message
  - **Problem**: how to combine fun and learning without losing the qualities of either or even both?
  - **Force**: too constrictive educational objectives will affect creativity and fun will be unlikely to emerge (and vice-versa)
  - **Solution**: make the knowledge expert and game expert work separately before combining their suggestions

- This pattern is about the design process, hardly visible in the game itself
2. Design principles

Patterns [Huynh-Kim-Bang et al., 2010]

- Pattern 2: **instructive gameplay**
  - **Context**: define possible game designs for action phases
  - **Problem**: how to exploit interaction that is conducive to learning?
  - **Force**: not all types of interaction are instructional, and not all types of knowledge can be assimilated with interaction
  - **Solution**: use modes of interaction adapted to the type of knowledge to be acquired
    - a) [low budget] Questions and answers
    - b) [memorize] Pavlonian interaction (repetitive tasks with stimulus)
    - c) [more abstract concepts] In-situ interaction (detailed narrative, emotional context)
    - d) [awareness] Build/modify a microworld
    - e) [discovering viewpoints] Social pedagogical interaction
    - f) Serious varied gameplay (mixing a-e)
2. Design principles

Patterns [Huynh-Kim-Bang et al., 2010]

- Pattern 2 (examples): **instructive gameplay**
  - [low budget] Questions and answers
  - [awareness] Build/modify a microworld
  - [discovering viewpoints] Social pedagogical interaction
Pattern 3: **time for action / time for thought**

- **Context:** high-level knowledge has to be included
- **Problem:** how to teach high-level knowledge?
- **Force:** cognitive overload may prevent learners/players from concentrating on game interactions while being engrossed in high-level thinking
- **Solution:** use intensive action phases for practice and training, and create less intensive phases for thought and reflection
2. Design principles

Patterns [Huynh-Kim-Bang et al., 2010]

- Pattern 4: **reified knowledge**
  - **Context:** -
  - **Problem:** how to help users become more aware of their acquired knowledge?
  - **Force:** -
  - **Solution:** represent items of knowledge or competencies (skills) with virtual objects to be collected
2. Design principles

Patterns [Huynh-Kim-Bang et al., 2010]

- Pattern 5: **museum**
  - **Context:** -
  - **Problem:** how to make players discover knowledge that is not related to the game objectives?
  - **Force:** some items of knowledge cannot be easily inserted into the game without breaking the rhythm
  - **Solution:** exhibit this knowledge in virtual places consistent with the game world, e.g., an exhibition place (a museum). The museum has to evoke the atmosphere and prolong the environment of the game world; it shall not be perceived as a totally separate location
2. Design principles

Patterns [Huynh-Kim-Bang et al., 2010]

- Pattern 6: **fun reward**
  - **Context:** -
  - **Problem:** how to provide players with incentives to help them advance in the game?
  - **Force:** -
  - **Solution:** entice players with the promise of rewards. The latter would bring some form of satisfaction or pleasure.

- BTW, fun/enjoyment can be caused by many things to which people are more or less sensitive
Outline

Lecture contents

1. Serious games
2. Design principles
3. Design / assessment frameworks
3. Design / assessment frameworks

- An alternative tool to design serious games is relying on frameworks.
- These frameworks highlight the key elements to consider in the design process:
  - Following an analytical process.
- They can be used to:
  - **Design** the game
  - **Assess** the quality of a game
3. Design / assessment frameworks

The DPE framework [Winn, 2008]

- Design, Play and Experience framework
  - Extends the MDA (mechanics, dynamics, affect) framework for game design
  - Focuses on the relationships between designers and users
3. Design / assessment frameworks

The SGDA Framework [Mitgutsch at al., 2008]

- Serious Game Design Assessment
  - Defines a serious game in terms of six key elements
  - Proposed for assessment, but can be used at design-time too
Mandatory literature

Can be tested in the exam


The first part is based on the book by Tracy Fullerton entitled “Game Design Workshop: A Playcentric Approach to Creating Innovative Games”, 3rd edition


Sawyer, Ben. "The “Serious Games” Landscape." Proceedings from Serious Game Days at the Game Developers Conference, San Jose. 2004
References