

Design Principles of Serious Games

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Structure of Presentation

- What is a game?
- What motivates people to play computer games?
- What are the learning principles of good games?
- What favourable features should be present in a computer game?
- Do GUI principles apply?
- Potential Guidelines for Designing a Serious Game
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What is a game?

- Salen & Zimmerman (2004) define a game as *"a game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome."*
- Crawford (1982) defines a game as *"a closed formal system that subjectively represents a subset of reality"*.

What is a game?

- Dempsey et al (2002) define a game as: *"A set of activities involving one or more players. It has goals, constraints, payoffs, and consequences. A game is rule-guided and artificial in some respects. Finally, a game involves some aspect of competition, even if that competition is with oneself."*
- Juul (2005) states *"A game is a rule-based system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels emotionally attached to the outcome, and the consequences of the activity are optional and negotiable."*

What is a game?

Leblanc (2000) promoted the following taxonomy:

- **Sensation** – player experiences pleasure when playing the game.
- **Fantasy** – player experiences immersion.
- **Narrative** – assumes the role of a particular character in a story.
- **Challenges** – The player encounters obstacles to overcome.
- **Fellowship** – Opportunity to connect with other players.
- **Discovery** – The ability to explore new territory and discover hidden attributes and function.
- **Expression** – The player has the ability to customise the game in some way to assert their individuality.
- **Masochism** – This means that the player can submit the character to violence, death and unacceptable social activity to derive pleasure.

What motivates people to play computer games?

- Based on a very wide review of the literature Ahlers *et al* (2002) identifies six dimensions or characteristics that can describe any game. These are six motivations for playing computer games and must be acknowledged when designing games for student centred learning. These six dimensions are:
- Fantasy, Rules/Goals, Sensory Stimuli, Challenge, Mystery and Control.

What motivates people to play computer games?

- Fantasy - Games are staged in the virtual (game) world and have absolutely no consequences in the real world beyond the limits of the game.
 - Exogenous
 - Endogenous
- Rules/Goals - A game must possess a set of precise rules to govern play, which means setting boundaries and constraints while at the same time make it possible to achieve the goals within a certain structure and with an element of challenge.
 - System rules
 - Procedural rules
 - Imported rules

What motivates people to play computer games?

- Sensory Stimuli - Appropriate sensory stimuli are achieved in computer games through the use of 3D graphics, sound effects, and now physical stimuli.
- Challenge - Malone and Lepper (1987) state that individuals require an optimal level of challenge.
 - Clear goals
 - Progressive difficulty levels
 - Track of progress through feedback
 - Meaningful goals

What motivates people to play computer games?

- Mystery – Curiosity is one of the primary factors that drives learning. There are two different types of curiosity:
 - Sensory curiosity – This is the achieved through sensory stimuli i.e. graphics, sound, appropriate feedback.
 - Cognitive curiosity – a desire for knowledge.
- Control – the ability that the participant has to make choices in order to affect the game world.

What motivates people to play computer games?

Malone and Lepper (1987) present a framework of intrinsic motivation:

■ Individual Factors

- Challenge – This means that player must be able to vary the difficulty in the game to provide an appropriate level of challenge.
- Fantasy – Player should feel immersed in the game in relation to interaction with the characters and interaction of the virtual world.
- Curiosity – Sensory stimulation should be provided which is necessary to ensure prolonged participation in the game.
- Control – Player game should have the ability to make choices and see the consequences of their actions.

What motivates people to play computer games?

- Interpersonal Factors:
 - Cooperation – The player should experience satisfaction in the process of assisting others to achieve common goals.
 - Competition – The player should be able to compare their performance to the performance of other players.
 - Recognition – The player should feel satisfaction when their accomplishments are recognised by others.

What motivates people to play computer games?

	Study 1		Study 2	
Reasons	Importance	Mean rating	Mean rating	Importance
Challenge	1 st	4.04	3.87	1 st
Curiosity	2 nd	3.57	3.69	2 nd
Cooperation	3 rd	3.39	3.59	3 rd
Leisure	4 th	3.11	2.80	9 th
Competition	5 th	3.11	3.06	6 th
Control	6 th	2.89	3.06	6 th
Recognition	7 th	2.74	2.97	8 th
Fantasy	8 th	2.64	2.52	10 th
Pleasure			3.32	5 th
Relaxation			3.50	4 th

What are the learning principles of good games?

Gee (2003, 2004, and 2005) defines the following learning principles of good games:

- Identity - This is how a good game captures and immerses a player. To successfully learn a new domain of knowledge requires a learner to fully embrace a new identity, role and responsibilities.
- Can be done in 2 ways:
 - Assume an Identity
 - Create an identity



What are the learning principles of good games?

- **Interaction** – The very essence of a game is that it provides appropriate feedback and provides new problems in reaction to the player's actions and decisions.
- **Production** – In the most basic sense, players are producers in the virtual worlds they live in as the decisions that they make help to “write” the game. This possibly increases prolonged participation in the same game as altering the decision allows you to essentially produce a different game.

What are the learning principles of good games?

- **Risk Taking** – Good video games decrease the consequences of failure as players experience either a minimal of real world consequences or no real world consequences at all.
- **Customisation** – Players usually have the ability to customize a game to their own particular desired attributes. This may mean that the player can customize the desired difficulty level of the game or they may customize which character they play as or create.

What are the learning principles of good games?

- **Agency** – This means that a player has a sense of ownership over what they are doing. Agency is made possible by the previously discussed principles: Identity, Interaction, Production, Risk Taking and Customization.
- **Well-Order-Problems** – good games produce well-order problems that allow the learner to draw on previous experience to solve future problems and also move them at a gradual pace where the knowledge and experience can be appropriately assimilated.

What are the learning principles of good games?

- **Challenge and Consolidation** – Good games allow players to solve challenging problems in a way that they have sufficient practise so that solving the problem becomes almost second nature. The game then must present a new class of problem to further challenge the player.
- **“Just in Time” and “On Demand”** – Good games provide “Just in time” verbal information when the player needs it and can make use of it. “On demand” verbal information is when the player needs, wants and can make use of the information.

What are the learning principles of good games?

- **Situated Meaning** – Research shows that only when words can be attached to the experiences (actions, images, and dialogues) they refer to, can their meaning be properly learned.
- **Pleasantly frustrating** – Due to a combination of the above-mentioned principles; good games have to have realistically attainable goals that are at the outer edge, of the players “regime of competence” (diSessa 2000).

What are the learning principles of good games?

- **System thinking** – Good games encourage players to think about the effect of their decisions on the game world as a whole.
- **Exploration, Lateral thinking and rethinking of goals** – Games encourage a different attitude from moving too fast and also encourage lateral instead of linear thinking.

What are the learning principles of good games?

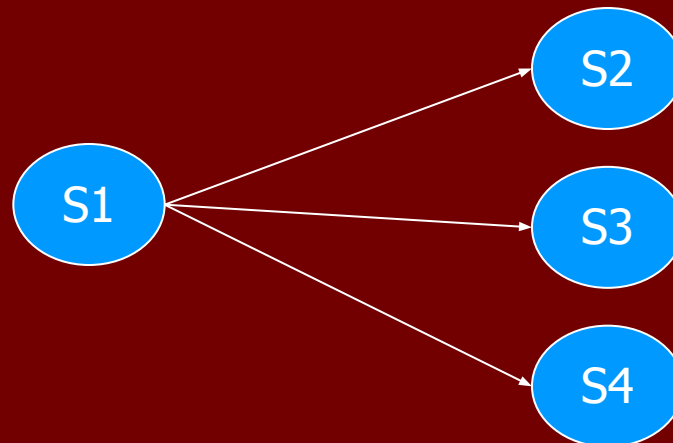
- **Smart Tools and Distributed Knowledge** – “Smart tools” are present in the game in many aspects of the game world. For Example: the characters or virtual character that the player manipulates in the game. Full Spectrum Warrior has virtual characters that have skills and knowledge of their own that is lent to play in order to assist the knowledge acquisition of the player. This means that the knowledge is distributed.

What are the learning principles of good games?

- **Cross-Functional Teams** – People specialize, but integrate and share, organised around a primary affiliation to their common goals and using their cultural and social differences as strategic resources, not as barriers.
- **Performance Before Competence** – Good video games operate by a principle just the reverse of most schools: performance before competence

What favourable features should be present in a computer game

- **Game world** – The illusion of free will should be provided in a game, by the employment of the intricate web of cause and effect. This means that a game cannot simply move linearly like a story or movie does. The player should have as much freedom as possible within the confines of the constraints of the game.



What favourable features should be present in a computer game

- **Synthetic players** – These are the computer-controlled characters that inhabit the game world with the main character.
- Smed *et al* (2003) identify the following four major features that should be provided by a synthetic character:
 - Real time response
 - Distribution
 - Autonomy
 - Communication

What favourable features should be present in a computer game

- **Multi-playing** – Complex interaction between multiple human players and synthetic players allows the game to form a storyline of its own, which can result in prolonged participation due to the fact that the novelty takes far longer to wear off.
- **Extensions** – The main ways of providing extensions to games are the following:
 - Modifications
 - Extension packs

What favourable features should be present in a computer game

- **Replaying** – The concept of replaying in this context does not mean that the game should be replayed, but that there should be a replay facility so that the players can relive the highlights of their own particular gaming experience. This is attempting to mimic real life as in real life people take photographs and video tape their joyful experiences in order to recapture them later.

Do GUI principles apply?

- **User Centred Design**
- **Directness of Manipulation**
- **Metaphors**
- **Consistency**
- **Appropriate Feedback**
- **Aesthetics**
- **Forgiveness**
- **Simplicity**
- **Human Memory Limitations**
- **System messages**

Potential Guidelines for Designing a Serious Game

- Begin with an initial problem grounded in professional practise. Has to be realistic and complex enough to develop analytical and problem solving skills.
- The learners have to take responsibility for their learning and be aware of the knowledge construction process.
- Allows the learner to identify his or her own process to reach a solution.
- Provide learners with the opportunity to experience and appreciate other perspectives (this may come about as part of the next principle).
- Provide opportunities for interaction and collaboration, either learner – learner, learner – teacher, learner – system.

Potential Guidelines for Designing a Serious Game

- Ensure that the learning environment motivates, engages and challenges the learner.
- Provide feedback mechanisms to enable learners to be fully aware of their progress.
- Provide support mechanisms for learners using coaching and scaffolding.
- Ensure flexibility in order to support different learning styles.
- Provide opportunities for reflection, self-evaluation, articulation and debriefing.
- Provide an integrated assessment.

Additional Issues

- From a computer game programmer point of view the – vendors prefer to see on screen results. Most complicated programming is likely to get the least amount of thanks.
- Gender Inclusive – Avatar selection.