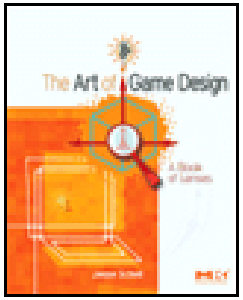
Systems Engineering Advancement Research Initiative

Basics of Game Design

Most of the content and images are drawn from:



Schell, Jesse, *The Art of Game Design: A book of lenses*, Elsevier, 2008.
(Available online through MIT libraries)

Presented by **Adam Ross**

Friday, June 14, 2013

E38-555

What is a Game?

- Games have the following characteristics:
  - Entered willfully
  - Have goals
  - Have conflict
  - Can be won and lost
  - Are interactive
  - Have challenge
  - Can create their own internal value
  - Engage players
  - Are closed, formal systems
- Examples of games:
  - Card games (e.g. poker, blackjack)
  - Sports games (e.g. baseball, basketball)
  - Board games (e.g. monopoly, chess)
  - Video games (e.g. super mario brothers, tetris)

A game is a problem-solving activity, approached with a playful attitude
Schell 2008, pg 37

What's a "Toy"?

Spectrum of Game Types

- Entertainment
- "Edutainment" = "Serious" games

  see: "Serious Games Taxonomy," Sawyer and Smith, Serious Games Initiative 2008.
- Education
- Simulations
  - Management flight simulators
  - Aircraft flight simulators

(Aldrich 2009)

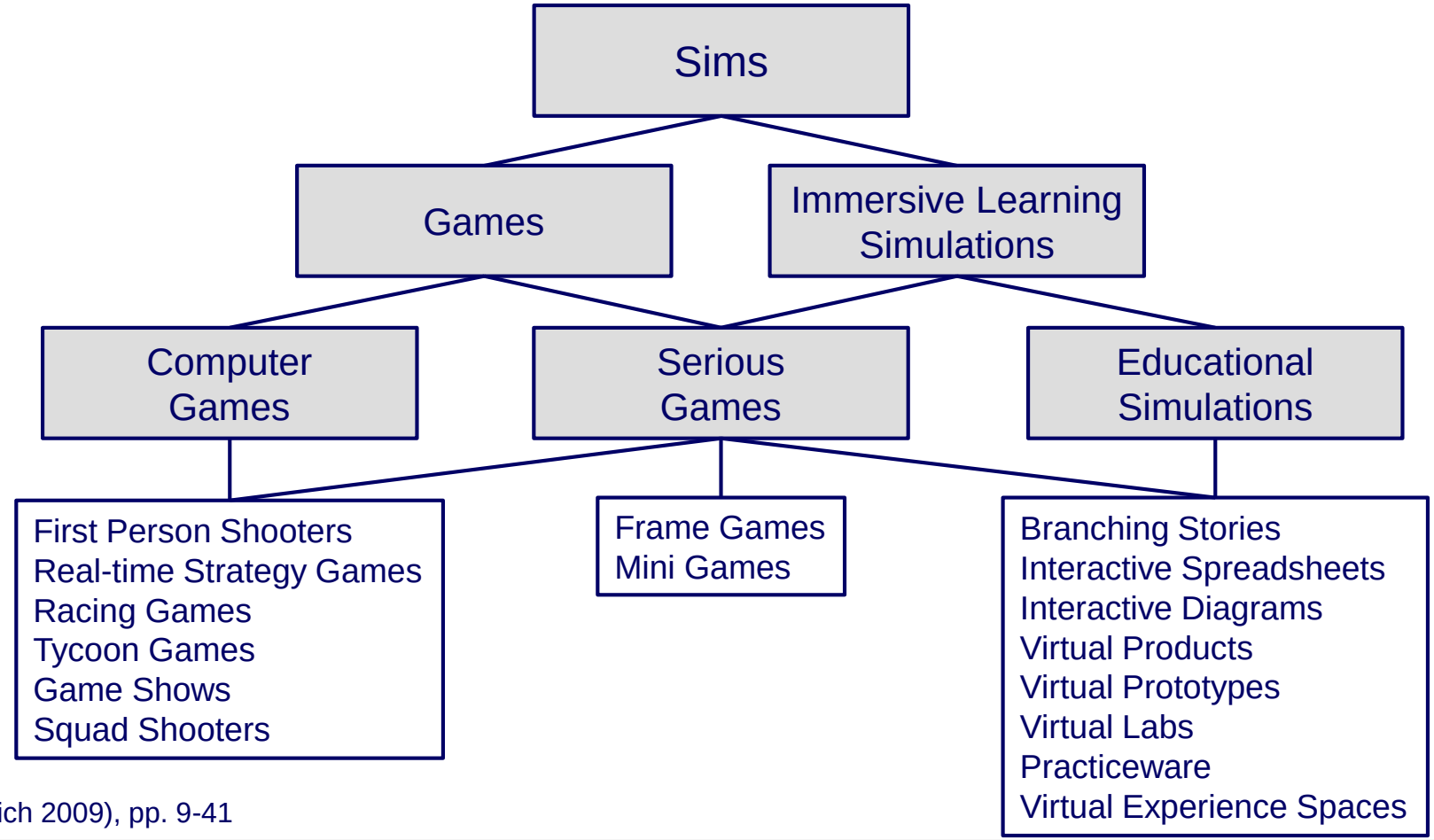
Monopoly: Classic family board game by Hasbro; buy and sell properties in Atlantic City

Windfall: a strategy game about building wind farms to create clean energy profitably. *Persuasive Games* (http://www.persuasivegames.com)

Microsoft Flight Simulator X: Gold Edition: Experience realistic flights with day/night and weather effects, multiplayer races and over 80 missions worldwide

Whether stated goal is to teach a lesson or to escape reality, the main purpose of games is to create an "experience" in the mind of the player

“Simulation” as Organizing Idea for Computer-based Games



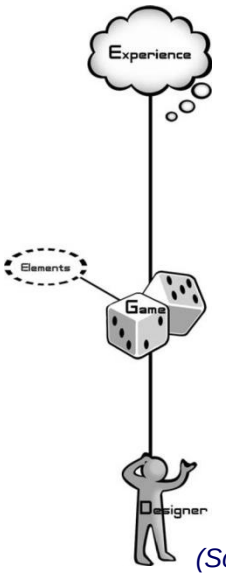
(Aldrich 2009), pp. 9-41

A game does not have to be on a computer; many game design techniques can be used across many technologies (e.g. card games, sports, as well as computer games)

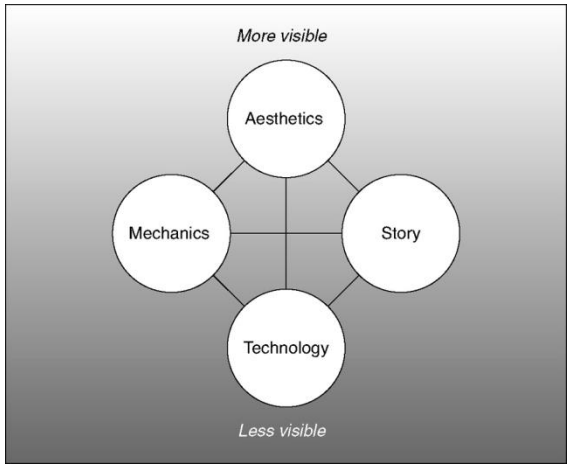
Four Basic Elements of a Game

- Mechanics
  - Procedures and rules of a game
  - Describe the goals, how players can and cannot try to achieve them, and what happens when they try
- Story
  - Sequence of events that unfolds in a game
  - Linear and pre-scripted, or branching and emergent
- Aesthetics
  - How a game looks, sounds, smells, tastes, and feels
  - Has most direct impact on game experience
- Technology
  - Any materials and interactions that make a game possible, such as paper and pencil, plastic chits, or high-powered lasers
  - Is the medium in which aesthetics take place, in which mechanics occur, and through which a story is told

(Schell 2008), pp 41-43



(Schell 2008), pp 39



(Schell 2008), pp 42

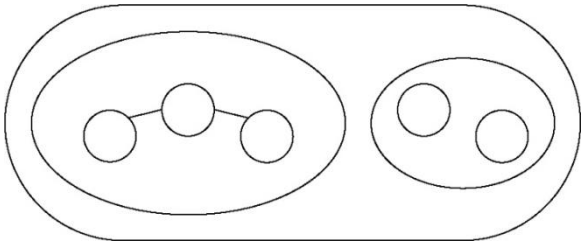
Game Mechanics

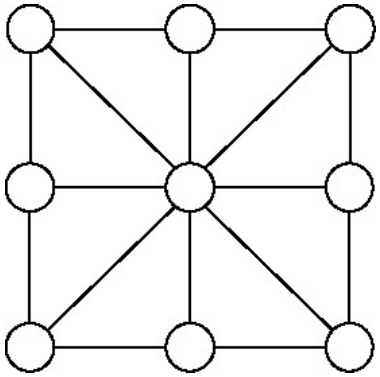
- Space
- Objects, Attributes, States
- Actions
- Rules
- Skill
- Chance

(Schell 2008), pp 129-170

Space and Objects

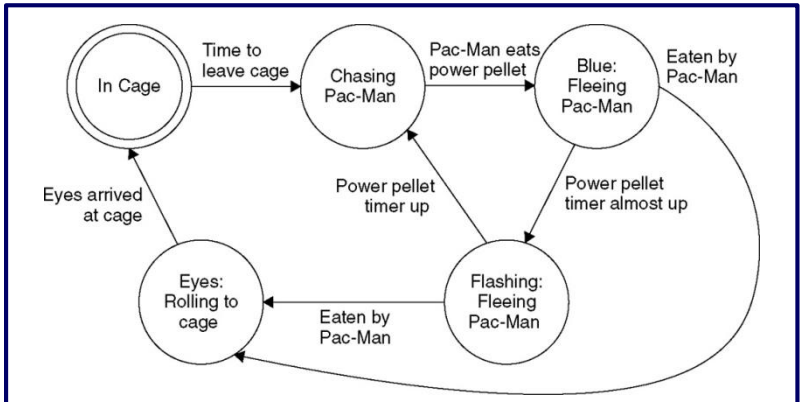
- Space
  - Discrete or continuous
  - Number of degrees of freedom
  - Boundaries





(Schell 2008), pp 134, 132

- Objects, Attributes, States
  - Object = “noun”
  - Attribute = “adjective” (category of information about object)
  - State = “level” of an attribute
  - Knowledge of states (private vs. public)



(Schell 2008), pp 137

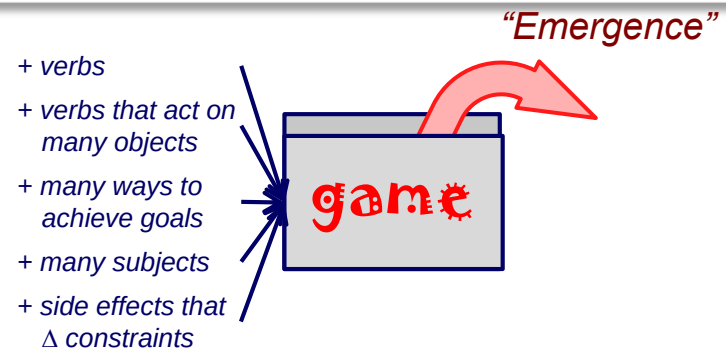
(Schell 2008), pp 130-139

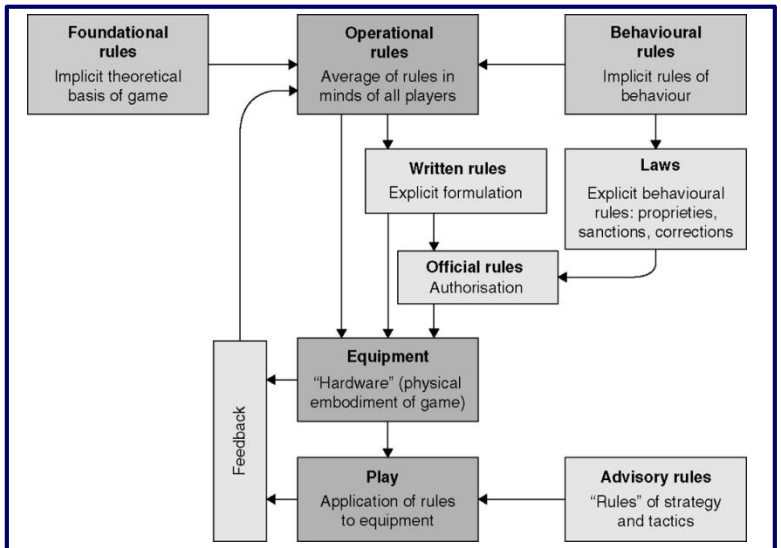
Actions and Rules

- Actions
  - Action = “verb”
  - Operative actions vs. resultant actions
- Rules
  - Operational rules = “how to play” game
  - Foundational rules = underlying formal structure
  - Behavioral rules = implicit rules for player behavior
  - Written rules = documented rules of the game
  - Laws = enforced rules (usually for competition)
  - Official rules = written rules merged with laws
  - Advisory rules = “rules of strategy” to help play better
  - House rules = local modified version of operational rules

(Schell 2008), pp 145-147

Video games allow for more complex rules since a computer can enforce the rules





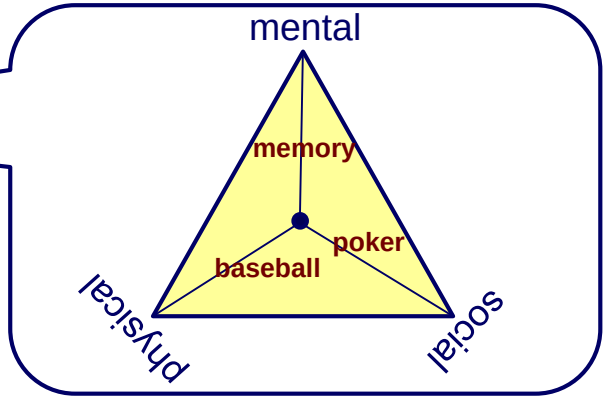
Parlett’s Rule Analysis in (Schell 2008), pp 145

Good game goals
concrete, achievable, rewarding

(Schell 2008), pp 148-149

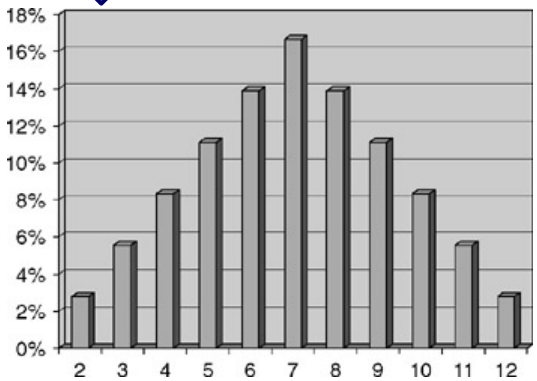
Skill and Chance

- Skill
  - Physical, mental, social



- Chance
  - Influence of uncertainty on other mechanics
  - Tangling of skill and chance
    - Estimating chance is a skill
    - Skills have probability of success (e.g. hedging)
    - Estimating an opponent's skill is a skill (e.g. bluffing)
    - Predicting pure chance is an imagined skill (e.g. "lucky streaks")
    - Controlling pure chance is an imagined skill (e.g. superstition)

(Schell 2008), pp 161



(Schell 2008), pp 151-169

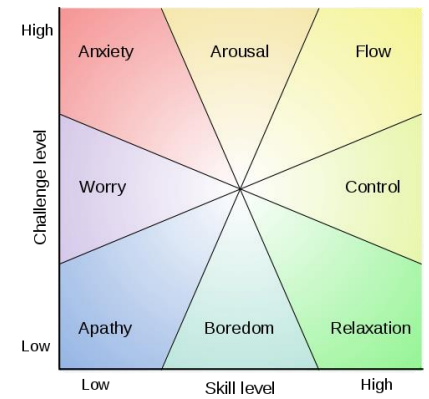
Games must allow some skill, not just chance, to influence likelihood success

Game Balance

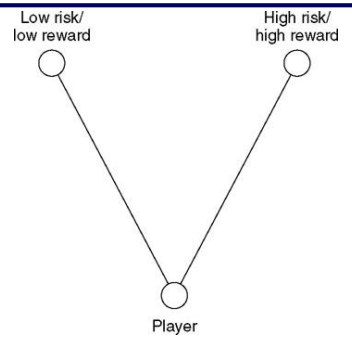
Twelve common types of balance

1. Fairness
2. Challenge vs. success
3. Meaningful choices
4. Skill vs. chance
5. Head vs. hands
6. Competition vs. cooperation
7. Short vs. long
8. Rewards
9. Punishment
10. Freedom vs. controlled experience
11. Simple vs. complex
12. Detail vs. imagination

(Schell 2008), pp 171-205



Csikszentmihalyi, M., Finding Flow, 1997.

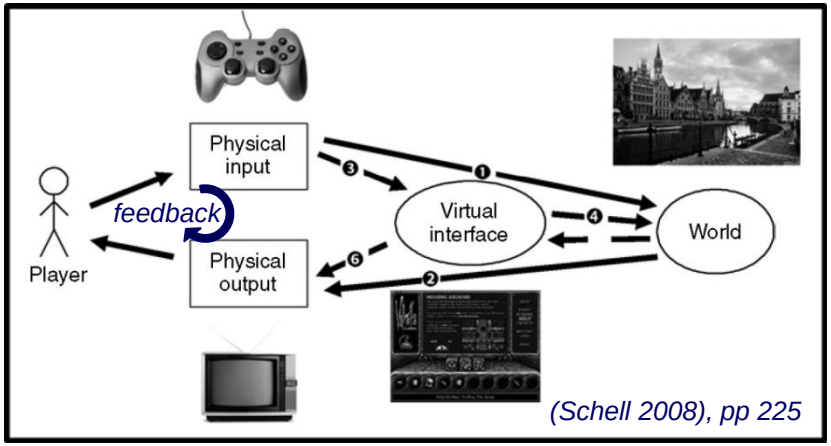


(Schell 2008), pp 181

Balancing is essential for a successful game; be sure to allocate enough time using various approaches (e.g. “doubling and halving”)

Interface for Interaction

- Basics
  - Transparency, Juiciness
  - Fun (pleasure with surprises)
- Interaction
  - Feedback is essential to learning
- Channels of Information
  - List and prioritize info
  - List channels (way to communicate stream of data, e.g. screen location)
  - Map info to channels
  - Review use of dimensions
- Other
  - A mode = change in mapping of interface; try to minimize #



Interface tips

1. Steal
2. Customize
3. Balance options and simplicity with layers
4. Theme the interface
5. Sound maps to touch
6. Use metaphors
7. Test, test, test!
8. Break the rules to help your player

(Schell 2008), pp 221-244

It is okay to reuse interfaces from other games since they will be more familiar (easier to learn) to the player and more likely to have been "proven"

The Story

"A sequence of events that is 'interesting'…"

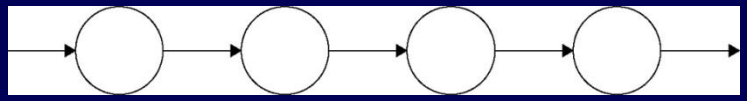
- Active entertainment
  - Engaging storytelling creates decision-making desire in the listener (e.g. guessing "what's next?")
  - Unity in a "story" can effectively compel engagement in the player (i.e., it is very difficult to create a "good" emergent story)
- Archetypes of stories

(Schell 2008), pp 261-281

- Frustration-resolution pairs
  - Learning and satisfaction occur through alternating frustration and resolution (obstacle, then overcoming the obstacle)
  - Both characters and players go through these pairs in their "journey"
  - Trick is for frustration to not exceed the "threshold to quit" (level varies by person)

(Aldrich 2009), pp 485-488

"String of pearls" storytelling: free explore, back to story, free explore, back to story, etc.



(Schell 2008), pp 264

"Story machine" storytelling: generate an "interesting" sequence of events, not pre-scripted

(Schell 2008), pp 265

Story tips

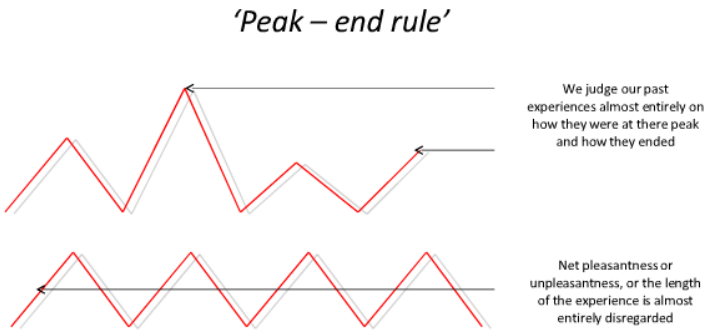
1. Goals, obstacles, and conflicts
2. Provide simplicity and transcendence
3. Consider the hero's journey
4. Put your story to work!
5. Keep your story world consistent
6. Make your story world accessible
7. Use clichés judiciously
8. Sometimes a map brings a story to life

Interest Curves

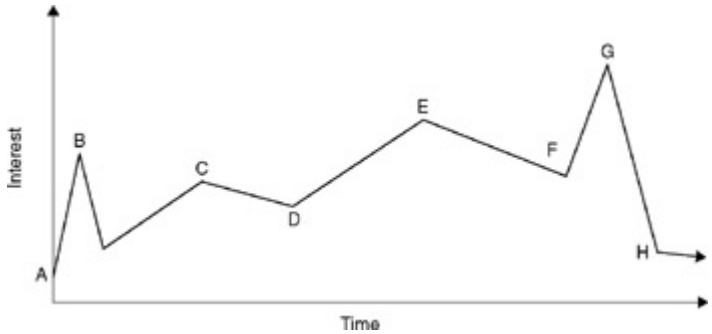
- Psychology of experience
- Peak-end rule (e.g. "duration neglect")

  Kahneman, D., *Well-being: The foundations of hedonic psychology*, 1999
  - Based on memory recall
- Desired curve shapes
  - Notice Schell has slightly different curve shapes

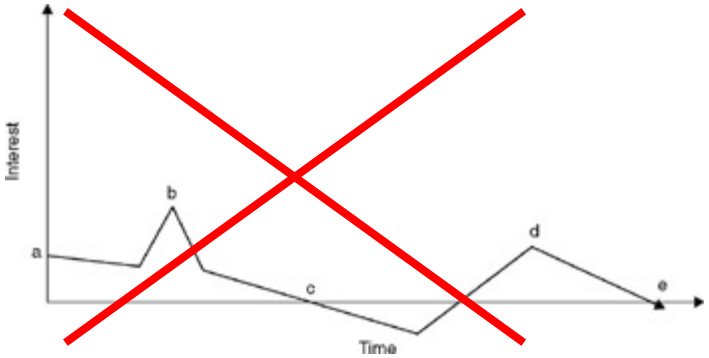
'Peak - end rule' on people's ***memory*** of ***experiences***



Peak-end rule shown graphically by Greg Ness



(Schell 2008), pp 248



(Schell 2008), pp 249

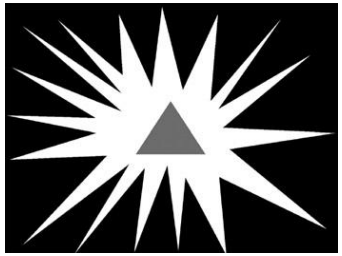
Experience will never be static, nor should it be; shape the timing of experiences to maximize interest by design

Indirect Control

- Feeling of freedom
  - Exciting for the player, but could overwhelm game design
- Methods for indirect control:
  1. Constraints
     - E.g. Limit number of choices
  2. Goals
     - Sculpt "world" around goals since player will likely pursue (e.g. fly in urinal)
  3. Interface
     - Provide select inputs to limit options (e.g. plastic guitar)
  4. Visual design
     - Layout affects where player looks (e.g. lines, emphasis, asymmetries)
  5. Characters
     - E.g. s.t. players *want* to obey/help
  6. Music
     - Can affect moods, desires, actions

(Schell 2008), pp 283-298

Center-focused



Edge-focused

(Schell 2008), pp 288

Fast music
- Speeds up actions
- Increases energy

Slow music
- Slows down actions
- Increases savoring

Aesthetics

Ocarina of Time

Wind Waker

Twilight Princess

Zelda images copyright Nintendo

- Value of aesthetics and experience
  - Look and feel are first impressions, luring or repelling players
  - People tend to forgive minor bugs if aesthetics are good
- Memory and depth of experience
  - Recall peak-end rule; try to shape the “peak” experiences to coincide with learning goals
- Finding balance
  - Use concept art freely, balancing “depth” and “breadth”
  - Use audio and consider from beginning to help shape the feel of the game

Aesthetics matter; the game has it even if not explicitly “designed”

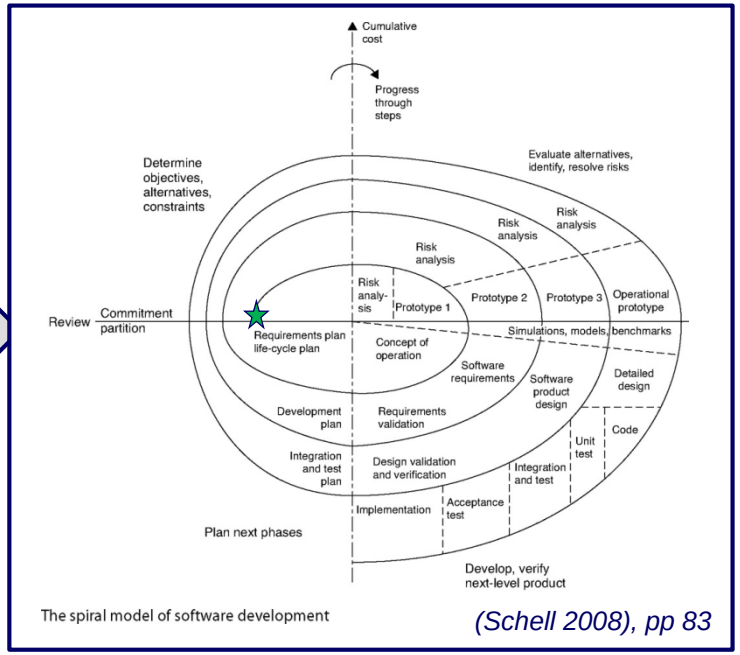
Iteration in Development

"the more times you test and improve your design, the better your game will be"
(*Schell, p. 80*)

- Choose an idea
- Rule of Loop
- Risk assessment and prototype

Spiral model proposed by Barry Boehm in 1986

(Schell 2008), pp 75-95



The spiral model of software development

(Schell 2008), pp 83

Practical interpretation of spiral model

1. State the problem.
2. Brainstorm and choose a design.
3. Figure out the greatest risks in your design.
4. Build prototypes that mitigate those risks.
5. Test the prototypes.
6. Come up with a more detailed design based on what you have learned.
7. Return to step 2.

Prototyping tips

1. Answer a question
2. Forget quality
3. Prioritize your prototypes
4. Parallelize prototypes productively
5. Don't get attached
6. It doesn't have to be digital
7. Pick a "fast loop" game engine
8. Build the "toy" first

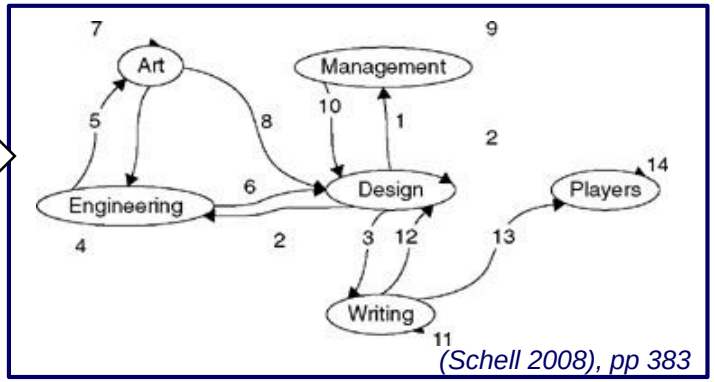
Teams and Documentation

- Designing together
  - more ideas, better filtering, more perspectives, ownership
- Team communication
  - Objectivity
  - Clarity
  - Persistence (keep records)
  - Comfort
  - Respect
  - Trust
  - Honesty
  - Privacy
  - Unity

(Schell 2008), pp 371-387

1. Game Design Overview
2. Detailed Design Document
3. Story Overview
4. Technical Design Document
5. Pipeline Overview
6. System Limitations
7. Art Bible
8. Concept Art Overview
9. Game Budget
10. Project Schedule
11. Story Bible
12. Script
13. Game Tutorial and Manual
14. Game Walkthrough

- "Game design document"
  - No perfect template
  - Purpose: memory and communication
- Types of useful documents



(Schell 2008), pp 383

  - Documents serve as boundary objects between design groups
  - Not all documents needed for every game

Playtesting

Does the game create the intended experience in the players?

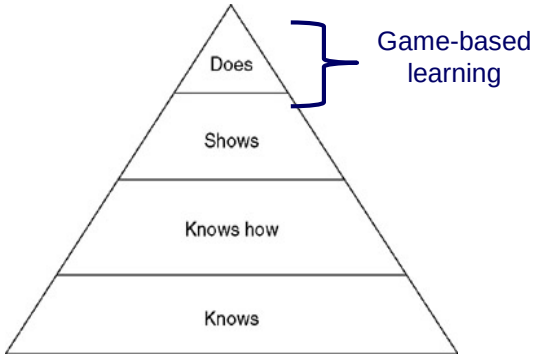
- Always playtest and repeat!
- Questions to ask
  - Why
    - Develop a list of questions to answer during a playtest
  - Who (target demographic)
    - Developers, friends, expert gamers, tissue testers
  - Where
    - Development studio, playtesting lab, public venue, playtester's home, on the internet
  - What
    - Things you know you are looking for (why list), Things you don't know you are looking for (surprises… be ready)
  - How
    - Developers present?, advance training?, where to look?, what data to collect during and after (surveys vs. interviews)?, disturb players mid-game?

Playtesting can be very difficult and uncomfortable, especially when people dislike the game; this is normal and why playtesting is essential to creating a good game

Transformation and Responsibility

- Can games be good or bad for us?
- Good for us
  - Emotional maintenance
  - Connecting
  - Exercise
  - Education
    - Facts
    - Problem Solving
    - New Insights
    - Curiosity
- Bad for us
  - Violence
  - Addiction

- Responsibility
  - Intend to do good
- Being accountable
  - Do no harm

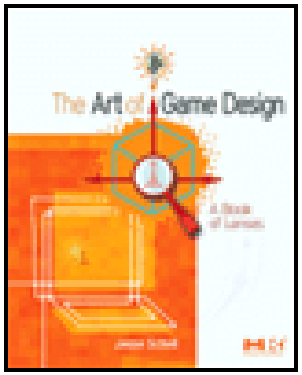


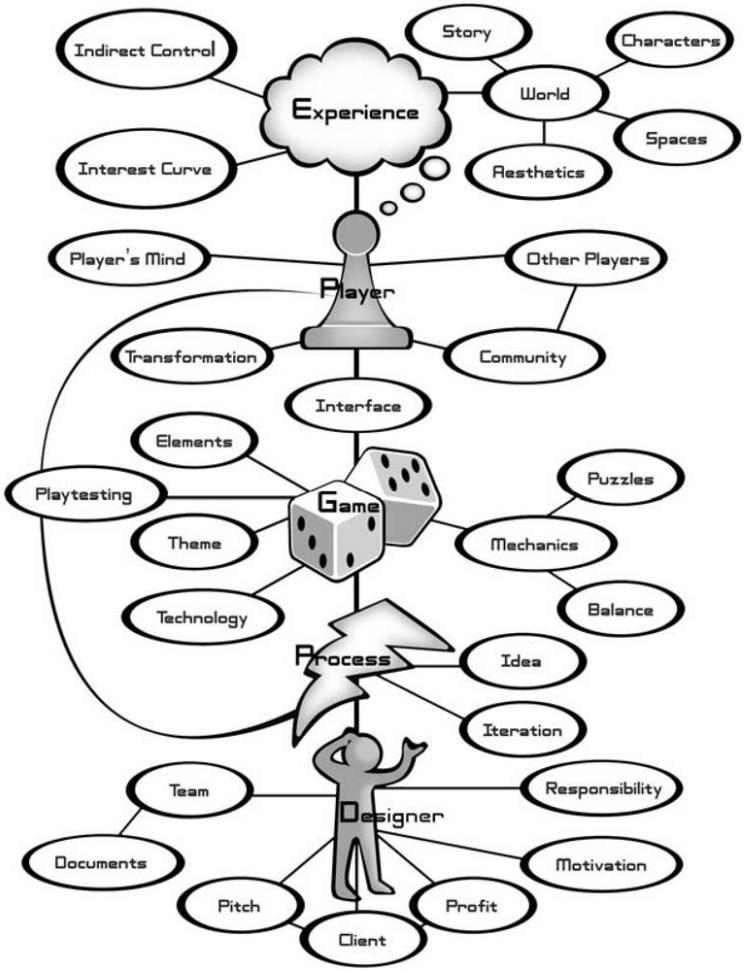
Miller's pyramid of learning in (Schell 2008), pp 445

Games are a powerful medium that creates (potentially transforming) experiences in players

Art of Game Design

Whenever you need a break from your other work, please read through *The Art of Game Design*, it is an easy read and quite useful





Schell, Jesse, *The Art of Game Design—A Book of Lenses*, Carnegie Mellon University, Elsevier: Burlington, pp. 489, 2008. (Available online through MIT libraries)

Games for Learning

- Most of this talk was on game design (for entertainment)
- Additional considerations must be made for pedagogical games (i.e. “serious games”)
- On Thursday, we have a guest lecture "Keeping the Play in Learning Games“ by Scot Osterweil, Creative Director of The Education Arcade
- We will provide you additional reading materials to learn more about serious games and organizations developing them

Important!

- Please make sure that you set aside time to play games
- Be sure to be “self-aware” when playing games, looking at your experience as well as the design of the game itself
- Try to keep an eye out for good and bad decisions game designers have made on these games
- Have fun (and understand the reason)!

Further Resources

- Game developer websites
  - www.igda.org
  - www.gamedev.net
  - www.gamasutra.com
- International Journal of Computer Games Research
  - http://gamestudies.org/1101
- Here at MIT
  - Game Lab (http://gamelab.mit.edu)
  - Education Arcade (http://www.educationarcade.org)
  - MIT/Open Courseware
    - 6.831 UI Design and Implementation (R.C. Miller)
    - 11.127J Computer Games and Simulations for Investigation and Education (E. Klopfer)
      - http://moodle.mitstep.org/course/view.php?id=8, (log in as guest)
- Other
  - EDTEC 670 Exploratory Learning through Educational Simulation & Games http://edweb.sdsu.edu/courses/edtec670/
  - Board games examples: http://edweb.sdsu.edu/courses/edtec670/cardboard/CardboardCognition.html
  - Game Design at CMU (Schell): http://gamedesign.etc.cmu.edu/ (blog not pwd-protcted)
  - Serious gaming at T-Exchange (Thales, University of Twente, the Netherlands) http://www.txchange.nl

Resources for Card and Board Games

- Cardboard Cognition
  - http://edweb.sdsu.edu/courses/edtec670/cardboard/CardboardCognition.html
  - Developed over 8 years at San Diego State University in EDTEC 670
  - More than 132 card games, 103 board games
- The Game Crafter
  - Custom, small-run publisher
  - Useful templates: http://www.thegamecrafter.com/publish/templates
- EDTEC 670 lectures on board game design
  - Summary: http://edweb.sdsu.edu/courses/edtec670/slides/Board.htm
  - Part 1: http://edweb.sdsu.edu/courses/edtec670/slides/Board1.pdf
  - Part 2: http://edweb.sdsu.edu/courses/edtec670/slides/Board2.pdf
  - Process: http://edweb.sdsu.edu/courses/edtec670/boardgame/BoardGameDesign1.html

Please read the EDTEC lectures and become familiar with a variety of games

Goals for week: familiarity with Space Tug Skirmish; be able to critically analyze games, recognizing SEAri constructs in these games

Primary Sources

Aldrich, Clark, *The Complete Guide to Simulations and Serious Games: How the Most Valuable Content Will be Created in the Age Beyond Gutenberg to Google*, Pfeiffer: San Francisco, pp. 576, 2009.

Schell, Jesse, *The Art of Game Design—A Book of Lenses*, Carnegie Mellon University, Elsevier: Burlington, pp. 489, 2008. (Available online through MIT libraries)