



# Interactive Media and Game Development

## Game Design



## Outline

- The Creative Process
- Core Design
- Game Balance





## Nurturing the Creative Process

- Creativity is not intellectual anarchy
- Thoughts are associative - generate new ideas by combining others (picture of lattice of association)
  - Trick is to notice patterns in association
  - Say, similarity between *post office delivery* and *network traffic routing*
- Facilitate creative process
  - Stuff head with concepts and associations
    - Can't notice association between Post Office and Network Routing if don't know anything about either
  - How? *Read* (All great game designers?)



## Nurturing the Creative Process - Read

- Make reading a lifelong process
- Broaden your reading
  - More than SciFi and Fantasy books
  - History, Religion, Politics, Culture
  - Game Design books
- Wonder as you read ("Why is the sky blue? Why do some coins have serrations on their edges?...")
  - Tightens up Web of associations
- Find answers to "wonders"
  - Once you find why sky is blue, will tell you why sunset is red (tightens associations further)
- Help build overall *creative foundation*





## Nurturing the Creative Process - Play Games

- More than computer games - *board games*
  - Columbia Games, Avalon Hill, Paper RPGs
  - Example: LOTR Confrontation, Reiner Knizia
- Even computer games, *broaden*
  - Pick titles you would not otherwise play
  - Like FPS games? Fine. But try different genres
  - Become a "student" of games. Learn from them.
  - Bargain bin, even, maybe not great games but maybe great ideas



## Nurturing the Creative Process - Sources of Inspiration

- Perhaps games not as broad as film
  - Shoot 'em ups like "Alien"
  - RPG's like "D&D"
  - Safe: "It's like Medal of Honor but in Desert Storm" ... how creative is that?
- Draw upon wide range of sources for inspiration
  - Opera, Movies with subtitles, Random lectures, scuba diving ... anything to remove *stale thinking*
- Originality in gameplay, story, setting, interface ...
  - Freshness to one, great game
  - Freshness to all, new genre!
- Stephen King - originality when put familiar together in unexpected ways
  - Ex: vampire in pirate setting (turns into a shark)





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## Gameplay Example (1 of 2)

- Adventure game: *knight* and *priest*
  - During combat, knight in front, priest in back
  - Priest casts spells (assume all cost the same)
    - E-bolts (do damage equal to sword)
    - Band-aids (heal equal to sword)
  - Which spell should Priest cast?
    - Ask: against single knight opponent (they are equal)
    - Ask: against opponent with 6 arms (bolts)
    - Ask: against opponent with weak attacks (band-aids)
- Can always decide which is better
- Not so interesting



## Gameplay Example (2 of 2)

- Now, suppose
  - Band-aids still affect single target but e-bolts have an area affect
  - E-bolts do less damage, but armor doesn't make a difference
- Now, which spell should Priest cast?
  - Answer isn't as easy. Interesting choices. Good gameplay.

"A game is a series of interesting choices."  
- Sid Meier (pirates, civilization...)



## Implementing Gameplay (1 of 2)

- Choices must be non-trivial, with *upside* and *downside*
  - If only upside, AI should take care of it
  - If only downside, no-one will ever use it
- Note, this is only regarding game theory
  - Ex: Could have ray gun that plays music. "Cool", but soon "gimme the BFG"
  - Ex: Nintendo's Smash Bro's has "Taunt" ... ask: what for?
  - Ask: other examples from popular games?
- Gameplay value when upside and downside *and* payoff depends upon other factors
  - Ex: Rohan horsemen, but what if other player recruits pikemen?
  - Ex: Bazooka, but what if other player gets out of tank?





## Implementing Gameplay (2 of 3)

- Should be *series* of interesting choices
  - Ex: Use of health potion now may depend upon whether have net for capturing more fairies
  - Having net may depend upon whether needed space for more arrows for bow
  - Needing arrows may depend upon whether killed all flying zombie bats yet
- Hence, well designed game should require *strategy*
- Game must display *complexity*
  - But doesn't mean it must be complex!
    - Don't make too many rules. Less if more.
    - Real world example: termites place one piece of mud. Results in hive, with cooling vents, etc.



## The Dominant Strategy Problem

- Articles with "10 killer tactics" or "ultimate weapon"
  - Ask: what are these doing?
  - Taking advantage of flaws in the game design!
- Should never have a option not worth using
  - *Dominated* strategy
- Should never have an option that is so good, it is never worth doing anything else
  - *Dominant* strategy



## Near Dominance

- Worth looking for near dominance, too
  - *Near-dominated* - useful only very narrow circumstance
  - *Near-dominant* - used most of the time
- Ex: *stun gun* only useful against raptors, so only useful on raptor level (near dominated)
  - Do I want it used more often?
  - How much effort on this feature?
  - Should I put in lots of special effects?
- Ex: *flurry of blows* most useful attack (near dominant) by Monk
  - Should we spend extra time for effects?



## Avoid Trivial Choices (1 of 2)

- Horsemen → Archers → Pikemen
  - *Transitive*, not so interesting
- Horsemen → Archers → Pikemen → Horsemen (picture)
  - Ask: what game does this look like? (rock-paper-scissors)
  - *Intransitive*, more interesting
  - Ex: from LOTR Battle for Middle Earth
    - Horsemen fast, get to archers quickly with lances
    - Pikemen spears hurt horsemen bad
    - Pikemen slow, so archers wait on them from afar

(Will look at *game balance* in depth, next topic)





## Avoid Trivial Choices (2 of 2)

- A beats B, B beats C, C beats A (could hardwire)
  - But could also have how *much* better
    - 1) Single horseman can beat any number of archers:  
Horseman  $\rightarrow$  Archers ( $\infty$ )
    - 2) Single horseman barely beat an archer:  
Horseman  $\rightarrow$  Archers (1.1)
- Ask: Which is better?
  - Trick question! Both are bad
    - Case 1) equal number of each, all others lose
    - Case 2) doesn't matter which you choose
- Don't want to hardwire. Sometimes A way better than B, sometimes a bit better, sometimes worse
  - The answer should depend upon the game situation, weather, terrain, time ... also what opponent is doing



## Ensuring Interesting Choices

- Interesting choices require good judgment on the part of the player
  - Correct choice must vary with circumstances
- Aim as designer, ensure circumstances don't stagnate and have only one right way to win
- No method for finding "best" choices
  - That's where creativity comes in (art)
- Still, some tips ...





## Toolbox of Interesting Choices

- Strategic versus Tactical
- Supporting Investments
- Versatility
- Compensating Factors
- Impermanence
- Shadow Costs
- Synergies



## Strategic versus Tactical (1 of 3)

- Strategic choices affect course of game over medium or long term
  - *Tactical* choices apply right *now*
  - Ex: build archers or swordsmen (strategic)
  - Ex: send archers or swordsmen to defend against invading force (tactical)
- Strategic choices have effect on tactical choices later
  - Ex: if don't build archers, can't use tactically later





## Strategic versus Tactical (2 of 3)

- Ex: *StarCraft*
  - Strategic choice: 1) upgrade range of marines, 2) upgrade damage, or 3) research faster fire
  - Which to choose?
    - If armored foes, Protoss Zealot, more damage
    - If fast foes, Zerglings, maybe faster fire
  - Other factors: number of marines, terrain, on offense or defense



## Strategic versus Tactical (3 of 3)

- Ex: *Warzone 2100* (ask: who played?)
  - Build factories to spawn war machines
  - If build in level, then spawn quickly but factory only used for that level
  - If build at base, spawn slowly (have to ship to front lines) but factory can be used in subsequent levels
- Lesson: Good gameplay should have different choices leading to different *kinds* of payoff
  - Reduces the risk of trivial choices
  - Increase scope for good judgment





## Supporting Investments

- Often game has primary goal (ex: beat enemy) but secondary goals (ex: build farms for resources)
- Some expenditures directly impact primary goal (ex: hire soldier), while others indirect (ex: build farm) called *supporting investments*
- Primary goals are "one-removed"
  - Ex: improve weapons, build extra barracks
- Supporting goals are "two-removed"
  - Ex: build smithy can then improve weapons
  - Ex: research construction lets you build smithy and build barracks (two and three removed)
    - Most interesting since strategic
- Payoff will depend upon what opponents do



## Versatility (1 of 2)

- Rule of thumb is to ask what is best and worst about choices:
  - 1) This move does most damage, but slowest
  - 2) This move is fastest, but makes defenseless
  - 3) This move best defense, but little damage
  - 4) This neither best nor worst, but most versatile
- Most should be best in some way
- Versatile good for
  - beginners
  - flexibility (against unpredictable or expert opponent)





## Versatility (2 of 2)

- Ex: beam can mine asteroids and shoot enemies
  - Versatility makes it good choice
- Speed is common way for versatility
  - Don't make fast units best
- If a versatile unit is also cheapest and most powerful → no interesting choice
  - (See "Compensating Factors", next)



## Compensating Factors

- Consider strategy game where all units impeded by some terrain
  - Ships can't go on land, tanks can't cross water, camel riders only in desert
- Assume flying unit that can go anywhere (Ask: how to balance?)
  - 1) Make slow
  - 2) Make weak, easily destroyed
  - 3) Make low surveillance range (unrealistic)
  - 4) Make expensive
- Note, last choice common but uninteresting since doesn't change tactical use
- Choice should be clear to player. Don't make a gamble before they know.
  - Ex: pick troops (cold weather) then find in jungle





## Impermanence (1 of 2)

- Some permanent (ex: you get to treasure first), others not (ex: I got storage near mine, but you can grab it off me)
- Really, another kind of compensating factor
  - I.e. - impermanence can compensate for something being really good
- Can be used for interesting choices
  - Ex: choice of medium armor for rest of game or invulnerable for 30 seconds?
- Advantage (or disadvantages) can be impermanent in number of ways:



## Impermanence (2 of 2)

- (Examples mostly from *Magic the Gathering - Battlegrounds*)
  - Can be destroyed (enchantments, ex: *gratuitous violence* makes units tough, but can be destroyed)
  - Can be stolen or converted (ex: *threaten* steals or converts enemy for short time)
  - Can be applied to something you don't always have (ex: *goblin king* gives bonus to goblins, but must have goblins)
  - Certain number of uses (ex: three grenades, but grenade spamming)
  - Last for some time (wears off, ex: Mario *invulnerable star*)
- Common in games, but deserves special attention





## Shadow Costs (1 of 2)

- In a game, continually presented with costs and trade-offs. But not all direct.
  - Ex: soldiers for gold, but need armory first for weapons and barracks for soldiers
  - Called *shadow costs* for supporting investments
  - Can make flow chart mapping shadow costs



## Shadow Costs (2 of 2)

- Ex: Age of Mythology has wood and food. Food is inexhaustible, wood is finite
  - Charioteer
    - Costs 60 wood, 40 food and 40 seconds to spawn
    - Shadow costs vary over game
      - Early on, food and wood expensive, spawn doesn't matter
      - Mid-game, much food and wood, spawn makes it harder to pump out new units
      - End-game, no wood, spawn is priceless
- Use variability to add subtlety to game. Vary environment and vary shadow costs (ex: more trees to vary cost of wood)
  - Challenge for level designer
  - Expert players will appreciate



## Synergies (1 of 2)

*Synergies* are interaction between different elements of player's strategies (note, terms may be different than ch 2.2)

- Positive Feedback
  - Economies of Scale - the more of one type, the better (ex: wizards draw strength from each other)
  - Economies of Scope - the more of a set, the better, or advantage of combined arms (ex: trident and net, infantry and tanks)
- Negative Feedback
  - Diseconomies of scale - first is most useful, others have less benefit (ex: diminishing returns from more peasants entering a mine since get in each other's way)
  - Diseconomies of scope - (ex: mixed troops go only as fast as slowest)



## Synergies (2 of 2)

- Ideally, all go together at once, but can emphasize
  - Ex: Chess is a game of positive feedback
  - Small advantage early on, exploited to crushing advantage
- Game of negative feedback needs other ways to keep interesting
  - Ex: trench combat makes a "catch-up" factor, or as get far from base, supply long grows, game lasts a long time
  - Ex: *Super NES NBA Jam* - catch up setting as an equalizer
- Be aware of each





## Review: Use Tools from Toolbox of Interesting Choices

- Strategic versus Tactical
- Supporting Investments
- Versatility
- Compensating Factors
- Impermanence
- Shadow Costs
- Synergies
- Groupwork:
  - Use 1-2 in a game about graduating from high school. Discuss.



## Outline

- The Creative Process
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- Game Balance





## Mini-Outline

- Broadly, game balance includes:
  - Player-Player (next)
  - Player-Gameplay
  - Gameplay-Gameplay



## Player/Player Balance

- Allow to arrange victory by skill and judgment
- Avoid results mostly as stroke of luck
  - Right from the start or magnified as game progresses (ex: start close to gold mine provides escalating advantage)
- Simplest way is to have symmetry
  - Same weapons, maneuvers, hit points (sports do this)
  - (But note, not always the most interesting. Want different moves on fighters, say. More later.)





## Symmetry

- Symmetry is fine in abstract games (ex: chess, even basketball)
- In realistic games, would be problem (ex: U.S. versus Iraq, game symmetry would be bothersome since not realistic)
- While easy, kind of an insult
  - Ex: LOTR BfME Warg's same as horses ... but Wargs can bite in book/movie!
- Better is *functional* symmetry that is not obvious



## Symmetry in Level Design

- Can avoid obvious symmetry
  - Ex: each player has impassible region on flank (water or mountain range)
    - Knights and soldiers can't cross
    - Later on, advanced units can cross
    - Choice of unit depends upon barrier
      - Mountaineers to storm, ships to cross sea
      - Or bluff, and then go up middle
- Players can choose asymmetric start location
  - Should not be deciding factor (Ex: you choose downwind port, so you lose)
  - Avoiding making start location critical decision
  - Ex: potential mines in many spots, so not critical





## Symmetry in Game Design (1 of 2)

- Make all choices for players functionally the same
  - Ex: *Warcraft 2* - humans have griffons and orcs have dragons; both flying toughies.
- But even slight differences make interesting
  - Ex: *Warcraft 2* - orc player's runes explode, making use in mountain passes good
- This "just broken" (a good thing) asymmetry easier to manage than total asymmetry (can compensate)



## Symmetry in Game Design (2 of 2)

- Making choices for players different, yet balanced is tougher
- Ex: *Starcraft*: Protoss, Zergs, Terrans - all very different (Same with *Command and Conquer - Generals*)
  - Imagine the hours of playtesting!
  - Recommend only for deep pockets
  - *Starcraft* is often a "benchmark" against which to judge other RTS game balance
- Also, if re-creating historical simulation, tradeoff between fairness and authenticity
  - Ex: *Conquistadors vs. Aztecs* - Aztecs are doomed, but may be no fun. Certainly not symmetric.



## Mini-Outline

- Broadly, game balance includes:
  - Player-Player
  - Player-Gameplay (next)
  - Gameplay-Gameplay



## Player/Gameplay Balance - Introduction (1 of 2)

- Means remembering that the business is about interactivity - think about player's relationship to the game
  - Ex: If had to "tune" the T.V. every time channel surf, would not do it much
  - Likewise, should not struggle for small reward
- Ex: *Baldur's Gate* (ask: who's played?)
  - Attributes are 3-18 (ask: why?), can re-roll if don't like. So, re-roll until all 18's. Ugh. Test of endurance!





## Player/Gameplay Balance - Introduction (2 of 2)

- Player/Gameplay balance entails balancing challenges against player's improvement curve
  - Many RPG's have monsters get tougher with level
    - Ex: Diablo 2 does this
    - But boring if that is all since will "feel" the same
  - Want *widening options*, too
    - Ex: character gets more abilities
- Three rules (more details on each next)
  - 1) Reward the player
  - 2) Let the machine do the work
  - 3) Make a game that you play with, not against



## Reward the Player

- Player will have to learn. Will make mistakes (discouraging). Want to offset with reward when do something right
- Ex: *Virtua Fighter*, takes longer to learn complicated moves
  - Sarah's backflip. Reward comes from seeing flip (eye candy) and punch in kidneys (payoff)
- Best when expand game options
  - Ex: "Now with backflip, I can see new use for reverse punch"
- In general, better to reward player for something *right* than punish for something *wrong*
  - Punishment makes players not want to play





## Let the Machine do the Work

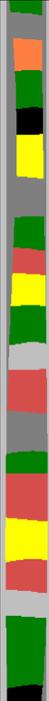
- Remember: If game option is no-brainer, consider AI taking care of it
- Interface should show player the world and let him/her manipulate
- Computer is tool to take care of wide-range of tedious tasks
  - If tasks are not fun, don't make player do them
- There is a blur of boundary between chore and game feature
  - RPG could provide graph so player can manually draw map as explore ... but is that fun?
  - Ex: In D&D, can tell D.M. "we go back to the dungeon entrance". Easy, fun. What if a game makes player walk back over map that has been seen? Boring, no fun.
  - Ex: *Myst* provided lightning bolt move to avoid tedium
  - (Ask: other examples?)



## Make a Game that you Play With, Not Against

- Consider great story, graphics, immersion but only progress by trial and error ... is this fun?
- Ex: crossbowman guards exit
  1. Run up and attack. He's too fast. Back to save point (more on save points next).
  2. Drink potion. Sneak up. He shoots you. Back to save.
  3. Drop bottle as distraction. He comes looking. Shoots you. Back to save.
  4. Drink potion. Drop bottle. He walks by you. You escape!
  - Lazy design!
- Should succeed by skill and judgment, not trial and error





## Specific Example - The Save Game Problem (1 of 2)

- Designer talking about RPG
  - *Designer*: "I've got a great trap!" ... platform goes down to room. Player thinks treasure but really flame throwers. Player is toast!
  - *Tester*: "What if player jumps off?"
  - *D*: Thinks it's a loophole ... "Ok, teleport in then toast"
  - *T*: "What is the solution?"
  - *D*: "There isn't one." (surprised) "It's a killer trap. It will be fun."
  - *T*: "So, there's no clue for player? Charred remains on platform or something?"
  - *D*: "No. That's what the 'Save' feature is for."




## Specific Example - The Save Game Problem (2 of 2)

- Should be used only so players can go back to their Real Lives™ in between games
  - Or maybe to allow player to fully see folly of actions, for exploratory and dabbling
- Don't design game around need to save
  - Has become norm for many games, but too bad
  - Ex: murderous level can only get by trying all combat options
- Beginner player should be able to reason and come up with answer
  - Challenges get tougher (more sophisticated reasoning) as player and game progress, so appeals to more advanced player
  - But not trial and error





## Mini-Outline

- Broadly, game balance includes:
  - Player-Player
  - Player-Gameplay
  - Gameplay-Gameplay (next)



## Gameplay/Gameplay Balance

- Challenges when balancing aspects of gameplay?
  - Want variety of interesting choices, rather than single, dominant choice
  - Best choices depend upon choices of other players (or on AI)
  - Not easy to see how frequently different choices will be worth making, but need to know to balance game
- Sounds like catch-22? Can use simple concepts to make first guess
  - Then lots of play testing to fine tune! ☺



## Balance (1 of 2)

- Establish the value of each game choice
- For game balance, each choice must be reducible to simple value and factors must even out
- Involves not the relative values, but the way the choices interact
  - Ex: How important is ship speed relative to combat strength?
- Ex: Pirate game
  - Dreadnoughts > Galleons > Brigantines
  - All have identical functions
  - If Dreadnoughts 2x powerful, then (for balance) Galleons should take  $\frac{1}{2}$  time to spawn



## What if Balance not Easily Reducible?

- Ex: *Starcraft*
  - Mutalisks fly over any terrain, but cannot fight other fliers
  - Wraiths are not as tough, but can attack other fliers
  - Observers can see enemy, but not fight
  - There is no expression for values since different things!





## Balance (2 of 2)

- Envision as a set, where relative values based on one factor only:
  - Speed: Brigantines > Galleons > Dreadnoughts
  - Tuffness: Dreadnoughts > Galleons > Brigantines
  - Range: ...
- Can then combine to get average set combining all factors
- Then, adjust component values (often, through play testing) so all units are useful
- This attribute balance is harder (set of all problems)
- But if can get approximate picture of better strategies, can tweak component costs to get game balance



## A Game Balance Checklist (1 of 3)

- *Player-Player* - ensures game is fair. Increasingly important as multiplayer increases. Symmetry works for this, but asymmetry may be needed or more appealing (try "just broken"). Make sure any asymmetry doesn't magnify imbalance as game progresses.
- *Golden rule*: a player should never be put in an unwinnable situation through no fault of their own





## A Game Balance Checklist (2 of 3)

- *Player-Game* - ensures player never becomes frustrated. Continually brings player back for more. Interface should not present obstacles. Small rewards are needed to guide player (fancy animation or new powers). Best rewards widen options.
- *Golden rule*: The game should be fun to learn as well as to play, and it should be *more fun the more you master it*



## A Game Balance Checklist (3 of 3)

- *Gameplay-Gameplay* - makes sure no element redundant or useless. Can do briefly by making factor table for each attribute (fire, range ...) Make sure each best at something. RPS ensures each component dynamically best rather than statically so. Oblige player to alter tactics. Don't have to have every component equally useful. But cost, availability and ease of use should reflect value. Get right through playtesting.
- *Golden rule*: all options in game must be worth using sometime, net cost of each option must be on par with payoff

