



IMGD 1001 - The Game Development Process: Game Balance

by

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(with lots of input from Mark Claypool!)



Game Balance - Introduction

- Beauty in balanced games
 - Like Rolls Royce or Ball Machine in Airport
- Game without balance often unsatisfying and wasted effort (parts not in balance not used, so wasted effort)
- Broadly, game balance includes:
 - **Player-Player** – advantage only in skill (can be luck, but should be equal to both)
 - **Player-Gameplay** – learning curve matched by reward
 - **Gameplay-Gameplay** – Composite longbow does twice damage, should cost twice \$

Player/Player Balance (1 of 2)

- Players should have "fair" chance of winning
- Ex: *Virtua Fighter*
 - Say, Sarah Bryant beats Lion every time?
 - Does that mean unbalanced?
- Suppose friend said could beat everyone as Sarah Bryant all the time.
 - I'd say "prove it"
 - Would only be a problem if beginner as Sarah always beat expert as Lion
 - And if could choose characters? (choice)
 - Sarah versus Sarah?

Player/Player Balance (2 of 2)

- Allow to arrange victory by *skill and judgment*
- Avoid results mostly as stroke of luck
 - Right from the start or magnified as game progresses
- Simplest way is to have symmetry
 - Same weapons, maneuvers, hit points
 - But note:
 - Not always the most interesting.
 - Want different moves on fighters, say.
 - More later.

Symmetry - Example

- ❑ Two heroes square off for duel, poised in kung fu stance
- ❑ Hours pass. Days pass.
- ❑ Breeze comes by, spec of dust in one's eye
- ❑ Blinks, frowns then bows
- ❑ Know result without fight ... tiny asymmetry enough to decide outcome
- ❑ If breeze or dust decided game, is that ok?
 - No...you'd want your money back!
- ❑ Don't want to decide by factors out of control
 - Keep symmetric

Symmetry

- ❑ Symmetry is fine in abstract games (ex: chess, even basketball)
- ❑ In realistic games, would be problem
 - Droid army vs. Naboo
- ❑ While easy, kind of an insult
 - Ex: LOTR: Battle for Middle Earth
 - ❑ 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, mountain range, lava)
 - 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
 - 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
- "Just broken" 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 fun. Certainly not symmetric

Outline



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

Player/Gameplay Balance – Introduction (1 of 4)



- Means remembering that the business is about interactivity – think about player’s relationship to the game
 - Character control should not be the goal of the game
 - Likewise, should not struggle for small reward
- Ex: *Baldur’s Gate*
 - Attributes are 3-18 (ask: why?), can re-roll if don't like. So, re-roll until all 18s.
 - Ugh. Test of endurance!

Player/Gameplay Balance – Introduction (2 of 4)



- Player/Gameplay balance entails balancing challenges against player’s improvement curve

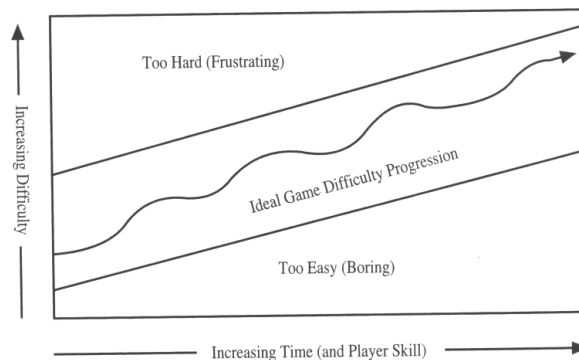


FIGURE 2.1.8 *A better flow.*

Player/Gameplay Balance – Introduction (3 of 4)



- Problem
 - Game starts easy (most do), and stays easy too long
 - Player quits from boredom
 - Game starts easy, then gets suddenly hard (add timing or requires new skill)
 - Player quits from frustration
- Ideally, game difficulty adapts to skill of play (track stats, etc.).
 - Ex: Give a lot of health for newbie, guy that gets wounded.
 - Great!
 - But a *lot* of work to build and testing to get right

Player/Gameplay Balance – Introduction (4 of 4)



- More common, have difficulty settings (player manually selects)
 - Still challenge of making the "Normal" level right.
- Compromises
 - Could ask player up front some questions (ex: have you played FPS before?), then recommend setting
 - Could have player do tutorial level, then recommend setting
- Getting more difficult
 - 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

Sub-Outline

- Again, true balance is an art, but three guidelines that can help
 - 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 done *right* than punish for something done *wrong*
 - Punishment makes players not want to play

Let the Machine do the Work

- 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 graphpaper 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
 - Other examples?
- Also, if game option is no-brainer, consider AI taking care of it

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

Outline

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

Gameplay/Gameplay Balance - Introduction

- Consider Warcraft 2, with dozens of units. Nearly perfectly balanced.
 - No unit costs so much you don't want
 - No unit too weak you can do without
- Either got lucky *or* lots of play testing (probably the latter)
- Strong R-P-S relationship
 - Have to play all units, none are dispensable

Gameplay/Gameplay Balance - Introduction



- 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)
 - As a designer, 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! ☺

Game Balance



- Establish the value of each game choice
- For game balance, each choice must
 - not be reducible to simple value (else easy to determine if dominates or dominated)
 - or
 - factors must even out
- Example where evens out: Pirate game
 - Dreadnoughts > Galleons > Brigantines
 - All have identical functions
 - If Dreadnoughts 2x more power, then (for balance) Galleons should take 1/2 time to spawn so will have 2 Galleons for each Dreadnought

Game Balance

- Example where doesn't even out: *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!
- Another example, in the Pirate game
 - Instead of spawn rate, compensate by making Dreadnoughts slowest, Brigantines fastest
 - Getting more interesting gameplay, but what about balance?

Game Balance

- Two levels to balancing: *component* and *attribute*
 - Component balance deals with relative values
 - Ex: how much does it "cost" relative to others?
 - Attribute involves interaction of abilities
 - Ex: how important is speed relative to damage?
- Envision as a set, where relative values based on one component only:
 - Speed: Brigantines > Galleons > Dreadnoughts
 - Tuffness: Dreadnoughts > Galleons > Brigantines
 - Range: ...
- Use weights to combine to get average set combining all factors based on perceived importance
- Then, adjust component values so all units are useful
 - How to adjust? Lots of play testing!
- Often need tools so level designers can balance

Component versus Attribute Balance



- Mnemonic to remember:
 - Component choices are about artifacts
 - Ex: "Hmm. Should I use the ion cannon or laser?"
 - Depends upon the tactical task
 - Attribute choices are more abstract regarding use:
 - Ex: "I should sneak past troll or take extra health"
 - Depends upon the strategy
- 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
(Next, component balance)

Intransitive Game Mechanics (1 of 5)



	Rock	Paper	Scissors
Rock	0	-1	+1
Paper	+1	0	-1
Scissors	-1	+1	0

- Payoff: match your choice with opponent
- Suppose I always picked rock. Then opponent would notice and pick paper. Then I would start to always pick scissors, then...
 - spiral to center of triangle where all options equal
 - only break even, like thermodynamics
- Note, too, that player must chose all in turn. No option that can do without (or opponent will exploit). It is *balanced*.

Intransitive Game Mechanics (2 of 5)



- Suppose scissors costs most, rock costs least
 - May use rock more often, scissors less
 - But wait, that would mean paper less useful, too... what is optimum choice now?
- Suppose scissors costs 3 ki, paper costs 2 ki, rock costs 1 ki and hit does 5 ki damage

	Rock	Paper	Scissors
Rock	0	-4	+7
Paper	+4	0	-4
Scissors	-7	+4	0

Ex: I choose scissors, you choose rock. Ki diff is -2. Plus damage is -5, so -7 total.

Intransitive Game Mechanics (3 of 5)



- Say payoff is R, P, S and frequency r, p, s
 - Want to know how often used (r, p, s)
- Net payoff R is $(0 \times r) + (-4 \times p) + (7 \times s)$
 - 1) $R = -4p + 7s$
 - 2) $P = 4r - 4s$
 - 3) $S = -7r + 4p$
- Sum must be zero (zero sum game, whatever one player gains other loses. Both cannot have net gain.)
 - $R + P + S = 0$
- All net costs must be equal else would favor (remember, triangle example)
 - $R = P = S$

Intransitive Game Mechanics (4 of 5)



- Solve: (3 equations in 3 unknowns)
 - (eq1) $-4p + 7s = 4r - 4s$ (eq2)
 $11s = 4r + 4p \rightarrow s = (4r+4p) / 11$
 - (plug s into eq2) $0 = 4r - 4(4r+4p)/11$
 $0 = 44r - 16r - 16p$
 $0 = 28r - 16p \rightarrow p = (7/4)r$
 - (plug p into eq1) $0 = -4(7/4)r + 7s$
 $0 = -7r + 7s$
 $r = s$
- Ratio $\rightarrow r:p:s = 1 : 1.75 : 1$
 - Rock and Scissors used 27%, Paper about 46%
 - Probably not what expected. Often result ... if one option more expensive, others are most affected

Intransitive Game Mechanics (5 of 5)



- Enhance to more choices.
 - Ex: could do combination moves.
 - Rock + Scissors + Scissors = *Garden Shears*
 - Could be countered with *Paper Weight*
 - Strategy becomes complicated
- Can use technique to:
 - Adjust costs to fit envisioned game play
 - Ex: if it turns out "too many" tanks relative to infantry
 - Justify spending more artistic assets
- Fine, all is balanced. Players must avoid predictability because clever opponent will exploit.
 - But that is barely above where have only 1 choice!
- To balance so interesting, must have attribute factors that interact (remember, the Battle of Hastings)
 - What year? Who were the "players"?

Other Intransitive Relationships

- Can extend RPS? Sure (otherwise not useful)
- More than 3 options → Table 5.3 and Case Study 5.5
- Less regular are 4 options → Table 5.4
- Figure 5.7 discusses another 4-way relationship
 - Infantry dominated
 - But, looking further, infantry has attribute that only one that doesn't have to move
 - Can hold territory! (In game that needs that)
 - Ex: In AoE, could "teleport" supplies by building base. Didn't need to hold territory. Infantry useless. Even making them cost less doesn't (expansion pack). Still great game, but didn't need.

Combinatorial Explosions

- How many components should there be to make interesting?
 - Too few? Then becomes trivial (Ex: in Hastings, only way to change power base is to put infantry on hill)
 - Too many? Then too hard to have skilled play
- Rule of thumb: N factors that could modify core mechanics, and each boolean (hill or not, rain or not ...)
 - 2^N possible combinations ... explodes rapidly (remember, $N=24$ gives about 16 million combinations)
 - Err on the side of caution

"In Populous (EA god-game), should have lots of characters or half-dozen? Noticed would be easier to understand game experience with few, versatile units rather than many specific ones."

Richard Leinfellner (executive in charge of Bullfrog)

Design Scalability

- Intransitive designs are inflexible
 - If have balanced relationship and remove one, will have dominated strategy
 - Ex: RPS and remove R ... always choose S!
- If project lead says behind schedule, so don't include 5th orc type
 - Elegant design falls like a house of cards!
- But is relatively easy to add components
 - Doesn't have to be symmetrical, can be redundant or useful in only a few cases
 - Ex: scout, or special spell
- Lesson, if you are going to scale, scale *up* not *down*

A Game-Balance Checklist (1 of 3)

- *Player-Player*
 - Ensures game is fair
 - Especially important for multiplayer games
 - 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-Gameplay*
 - Ensures player never becomes frustrated.
 - Continually brings player back for more.
 - Interface should not present obstacles.
 - Small rewards are needed to guide player
 - Ex: 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* –
 - Ensures no element redundant or useless
 - Can do briefly by making factor table for each attribute (Ex: 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