Balancing Free-to-Play Economies

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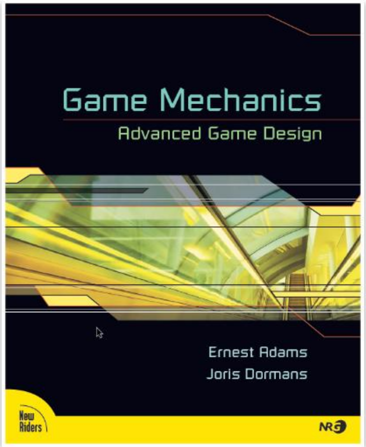
Who am I

- Former Producer at Glu and other companies, mostly with the free-to-play model.
- Former Game Economy Designer at Gameloft and Hibernum, worked on several mobile free-to-play titles.
- Now Data Analyst at Bethesda.
  - Necessary disclaimer: no information in this presentation is related to Bethesda’s games. ☺
  - Has to do with past experiences, lessons and the current state of the industry.

What’s an “Economy”

- *“In real life, an economy is a system in which resources are produced, consumed, and exchanged in quantifiable amounts. (…) In games, the internal economy can include all sorts of resources that are not part of a real-life economy - health, experience, and skill can be part of the economy just as easily as money, goods, and services.” – Ernest Adams*

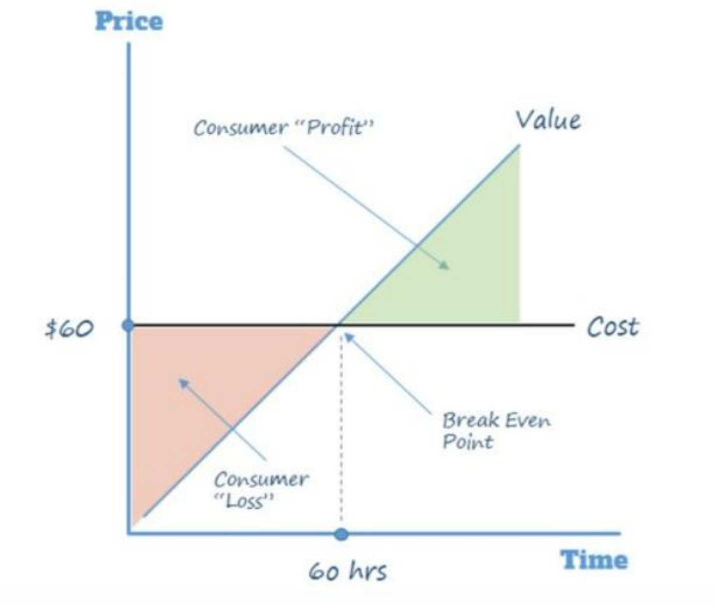


- Game Economy Design is ***not*** classical Economics
  - Concepts of Economics, but more to do with strong Game Design.
  - Design of Complex Systems with emergent features (metagame).
  - Closed systems with self-contained ecosystems.
  - Understanding of Programming and Probabilities helps a lot.

The perceived value timeline in F2P

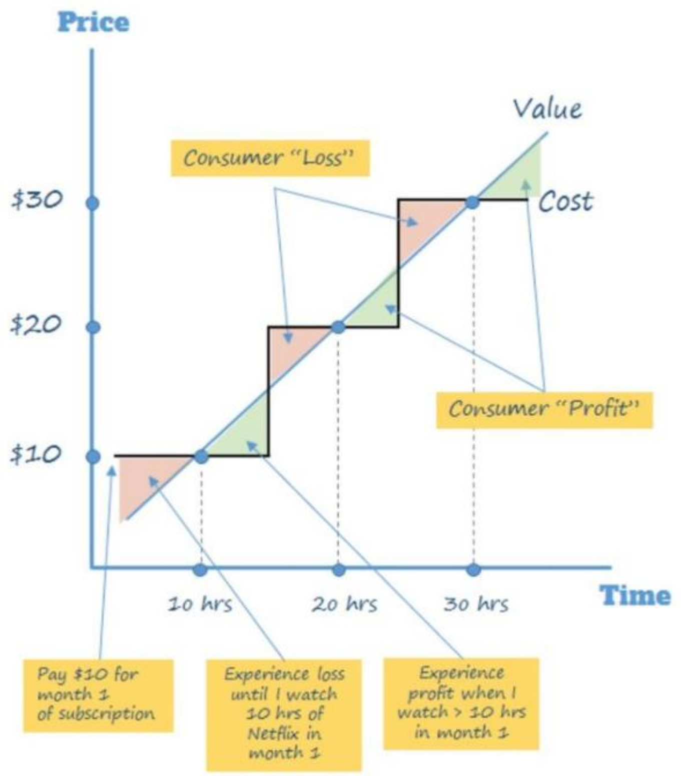
- How players acquire value over time (from Deconstructor of Fun):

Premium Model

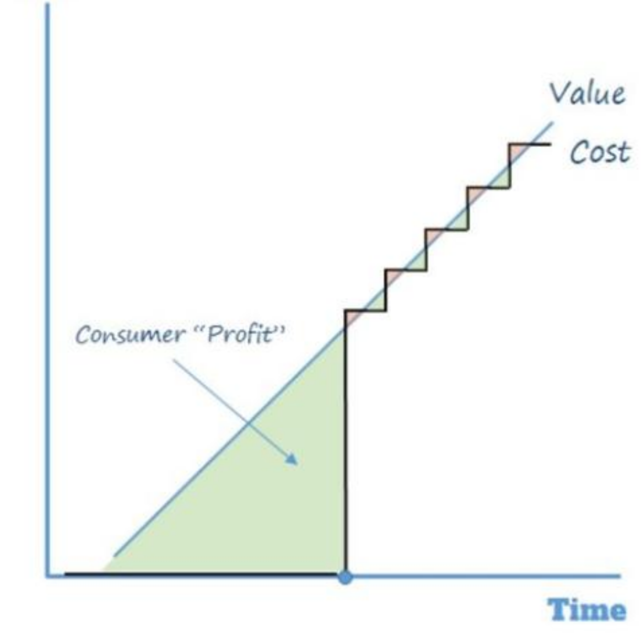


I pay a fixed cost of $60 to buy a game, but the value that I get increases over time. The old school model of games.

Subscription Model



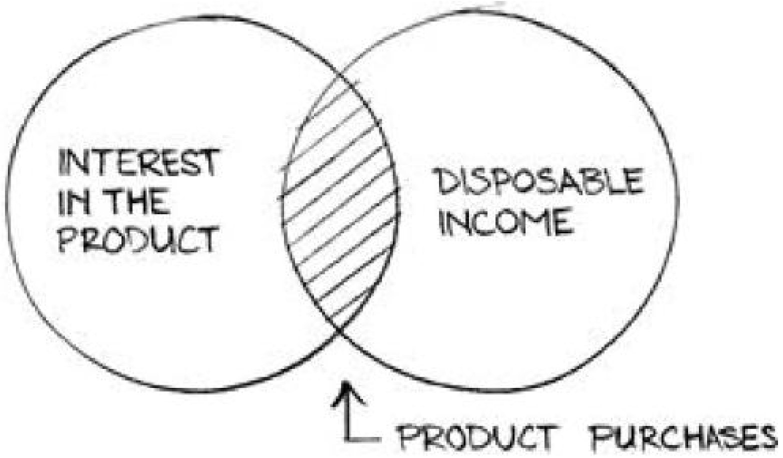
F2P Model



I get an abundance of consumer profit in the beginning with a free-to-play game because the cost to me is zero. However, as I progress I get pinched and I end up paying. At an aggregate level (i.e. across all players) users are paying for the product after trying it for free. Users get all consumer profit up front, but the profit is then split between consumer and producer later.

Goals of a Free-to-Play economy

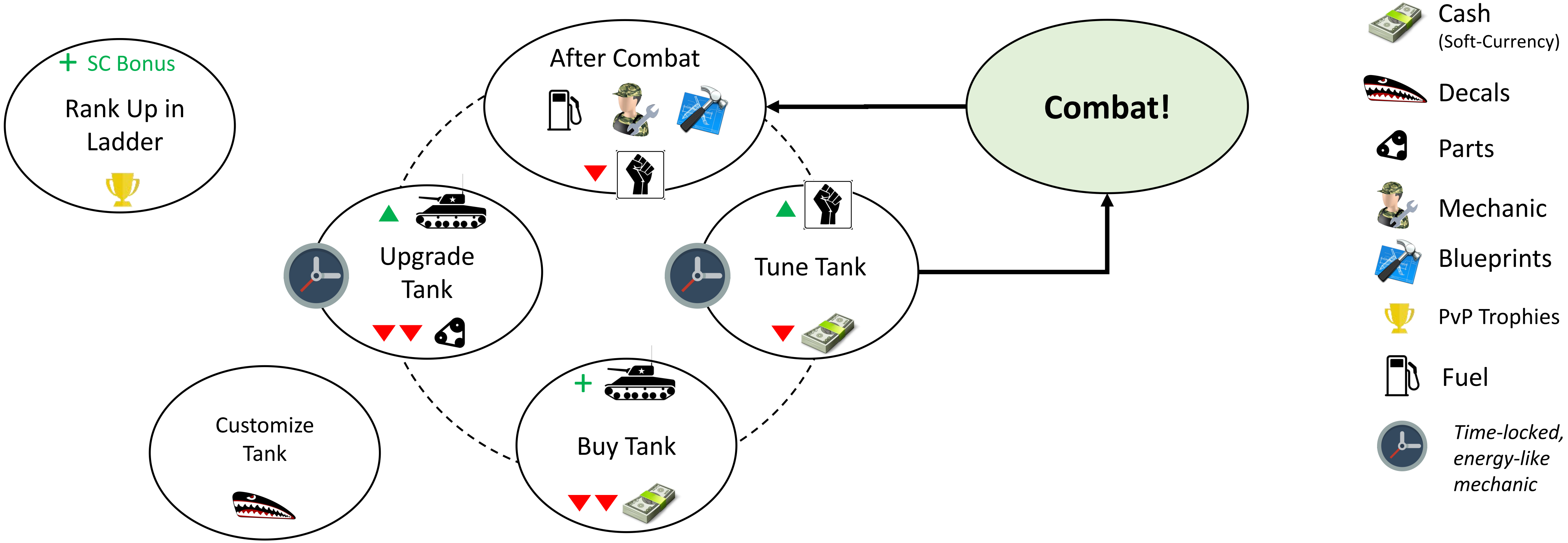
- Deliver a *lot* of value for free.
  - Quality should not be behind paywalls.
- Charge for an improved / faster grind, *not to play the game*.
- **Scale systems** so that monetization can be executed on the long-term value.
- Monetize without churning (avoid "paywalls")



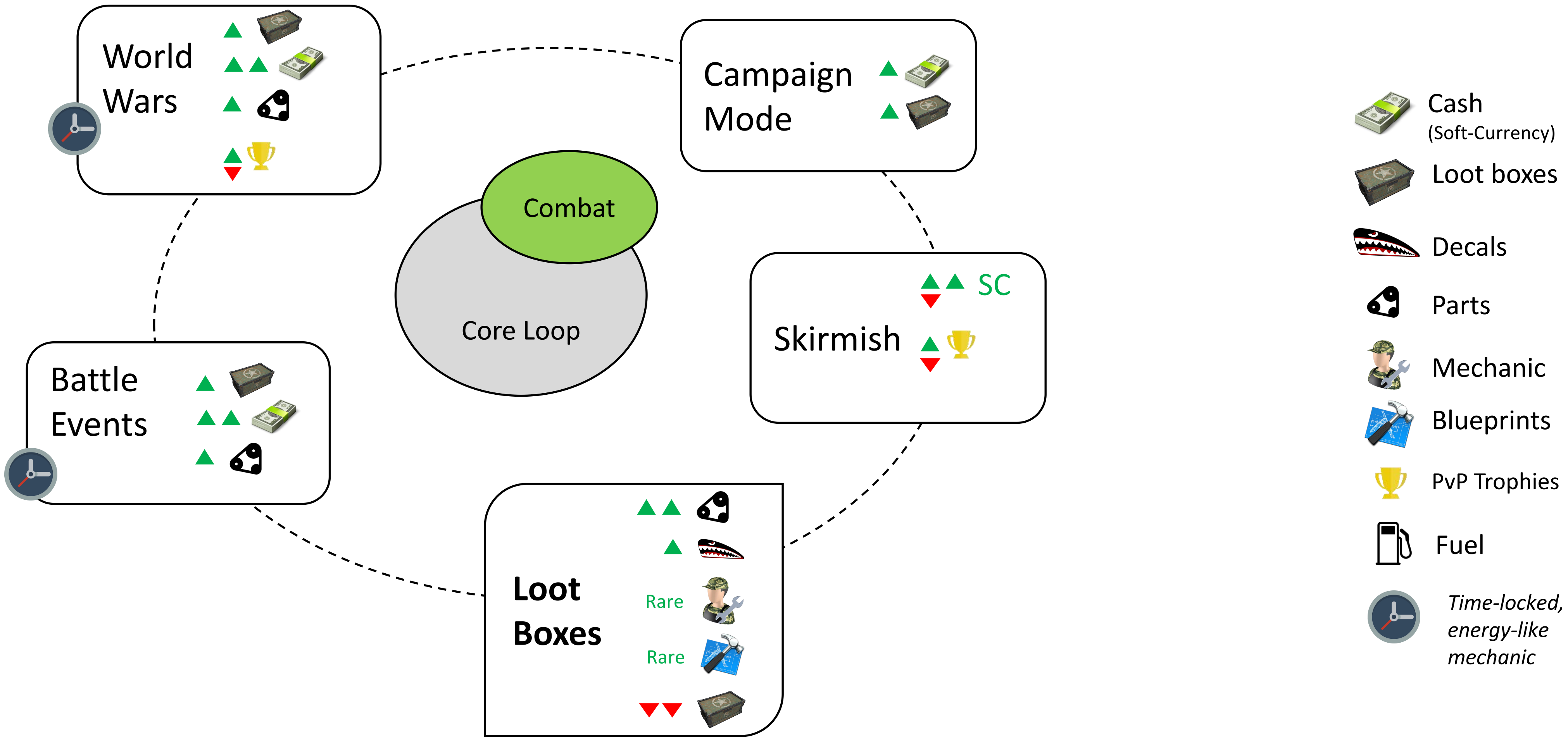
Source: Eric Benjamin Seufert

#: do a Resource Loop

- Taps and Sinks: assess the purpose of each feature in the economy.
- Visualize the "grand scheme of things".
- Start on the core game.

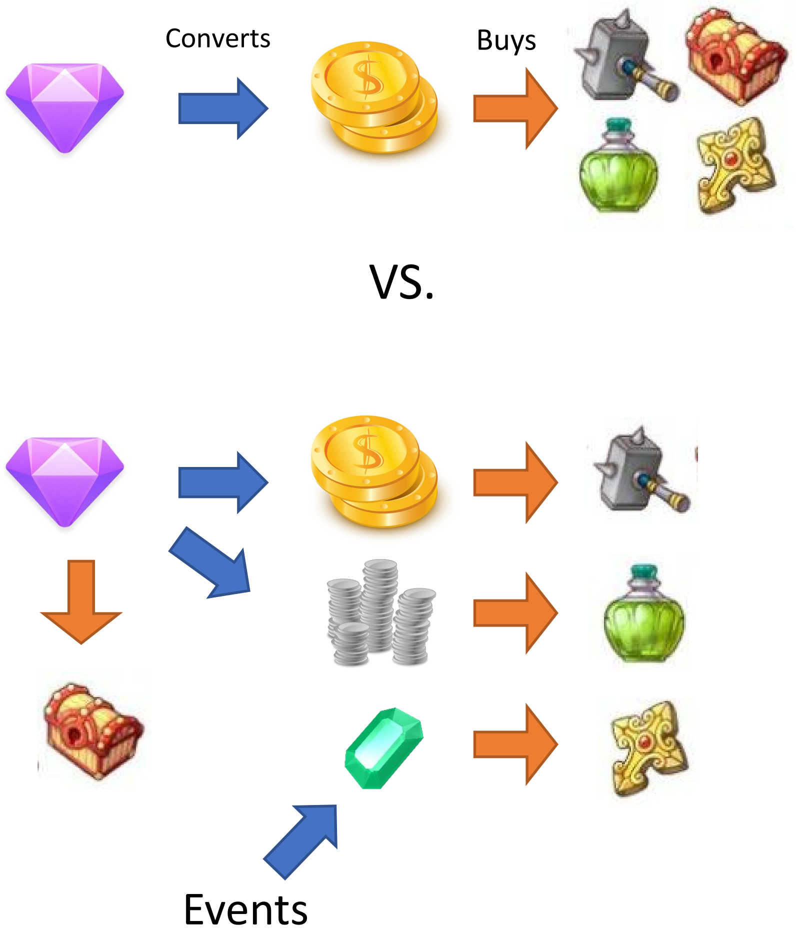


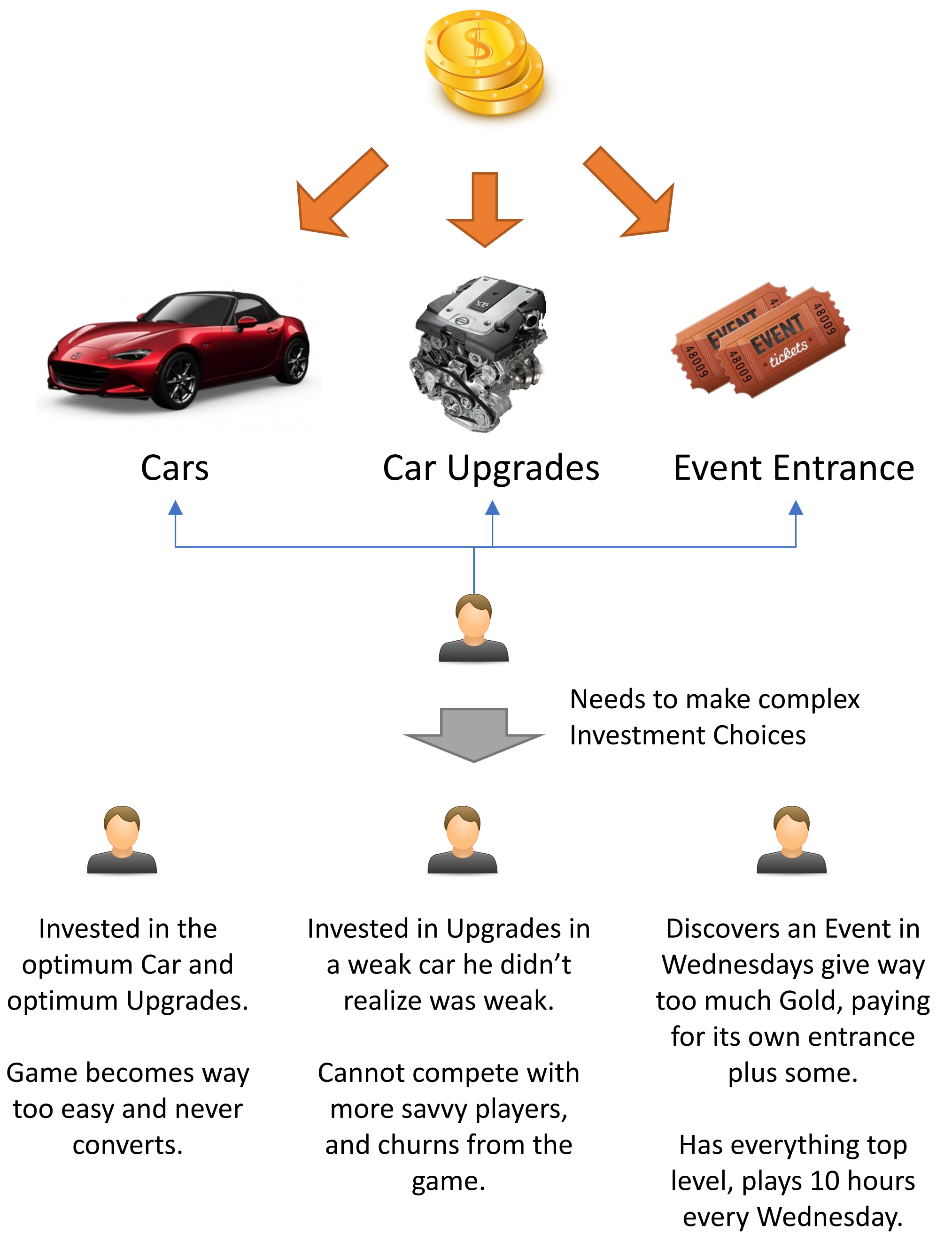
Expand to outer loops.



#: Specialized Resources are *easier to balance*

- Eliminate trade-off scenarios that result in more outliers;
  - Players who are either more powerful for finding "optimal strategies" or users stuck in dead-ends.
- More prone to farming strategies.
- Less prone to Inflation across updates.
  - And its hard to fix Inflation later on updates, because few users will have a LOT.
  - Pricing for them will punish everybody.
- More Design control over the pace of progress.
  - Some resources may not even be convertible to Hard-Currency, keeping access under tight control of weekly Events.
- More Live Ops possibilities.





Cars

Car Upgrades

Event Entrance

Needs to make complex Investment Choices

Invested in the optimum Car and optimum Upgrades.

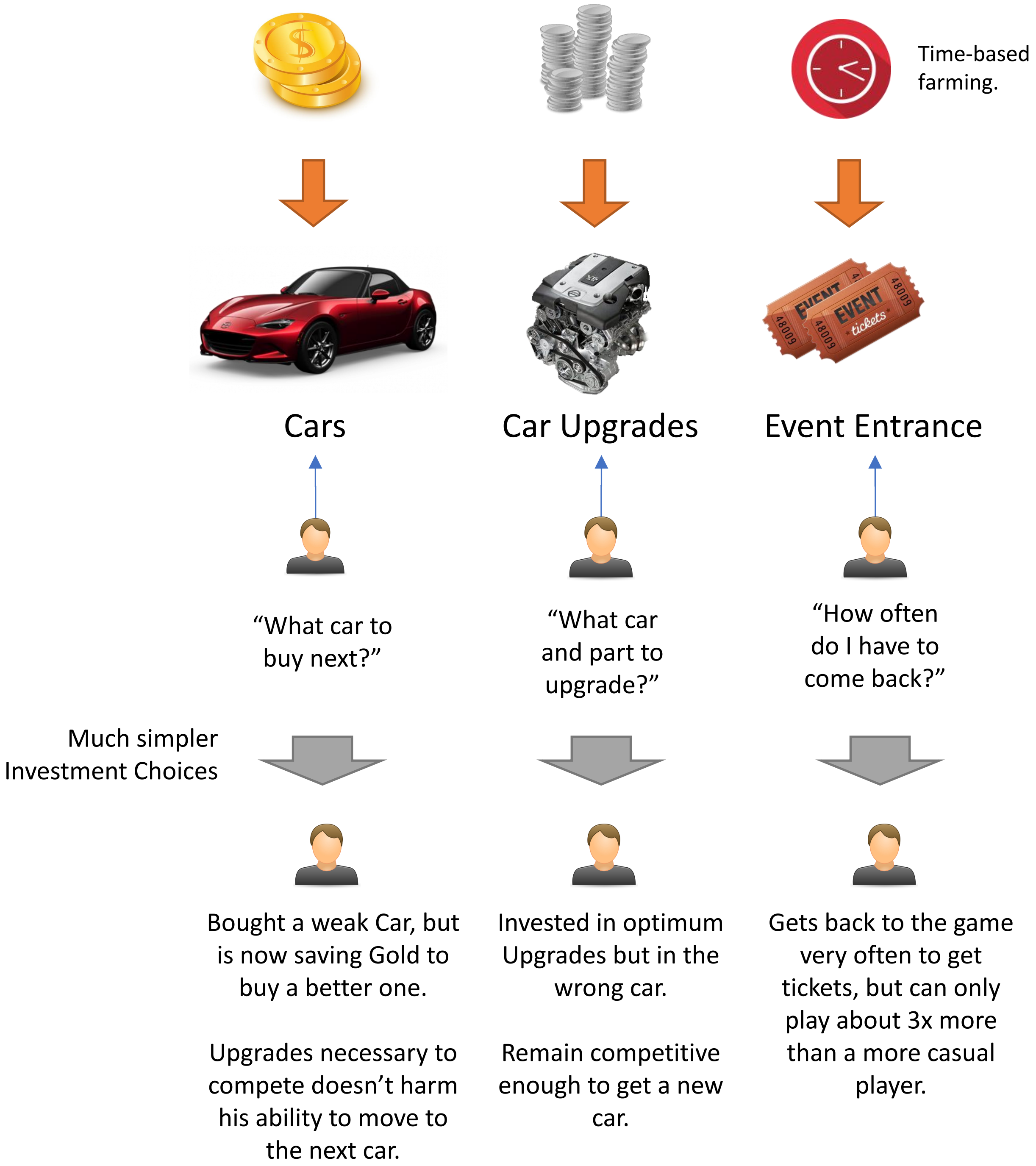
Game becomes way too easy and never converts.

Invested in Upgrades in a weak car he didn't realize was weak.

Cannot compete with more savvy players, and churns from the game.

Discovers an Event in Wednesdays give way too much Gold, paying for its own entrance plus some.

Has everything top level, plays 10 hours every Wednesday.



Time-based farming.

Cars

Car Upgrades

Event Entrance

"What car to buy next?"

"What car and part to upgrade?"

"How often do I have to come back?"

Much simpler Investment Choices

Bought a weak Car, but is now saving Gold to buy a better one.

Upgrades necessary to compete doesn't harm his ability to move to the next car.

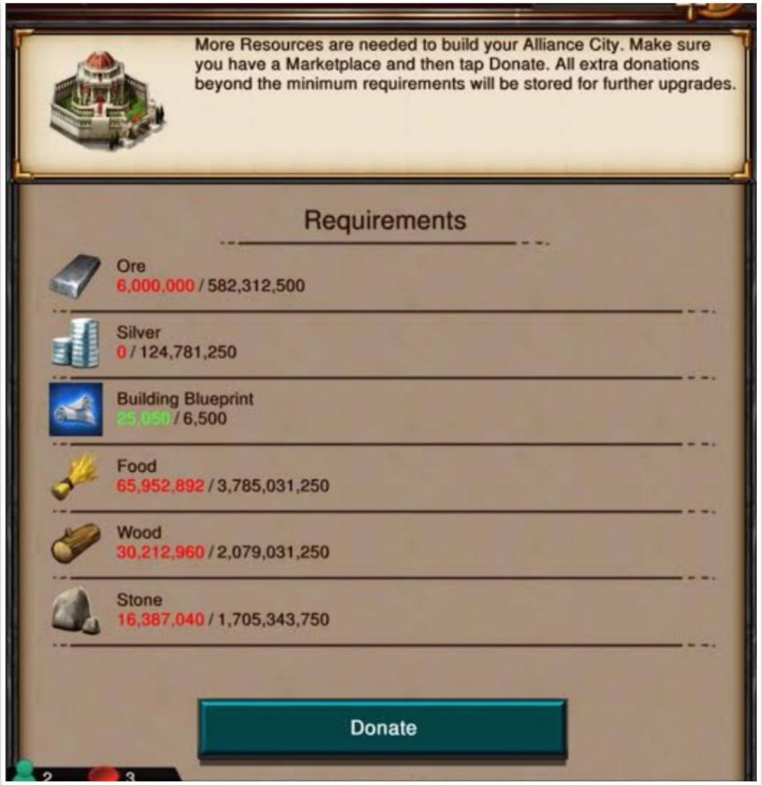
Invested in optimum Upgrades but in the wrong car.

Remain competitive enough to get a new car.

Gets back to the game very often to get tickets, but can only play about 3x more than a more casual player.

Shortcomings

- *Feels* less intuitive and more complicated
    - Because the real-world economy works on a single currency enabling everything.
    - But really: is Investment a simple thing in the real world? ☺
- Much more challenging for UI developers.
- More confusing to new players.
    - Extra currencies need to be introduced slowly.
    - More tutorials.
- Less choice can alienate the really hard-core community.
    - So end-game, hard-core designs with combinatorial explosions should be devised if you expect a lot of players like that.



More Resources are needed to build your Alliance City. Make sure you have a Marketplace and then tap Donate. All extra donations beyond the minimum requirements will be stored for further upgrades.

Requirements

Ore
6,000,000 / 582,312,500

Silver
0 / 124,781,250

Building Blueprint
25,050 / 6,500

Food
65,952,892 / 3,785,031,250

Wood
30,212,960 / 2,079,031,250

Stone
16,387,040 / 1,705,343,750

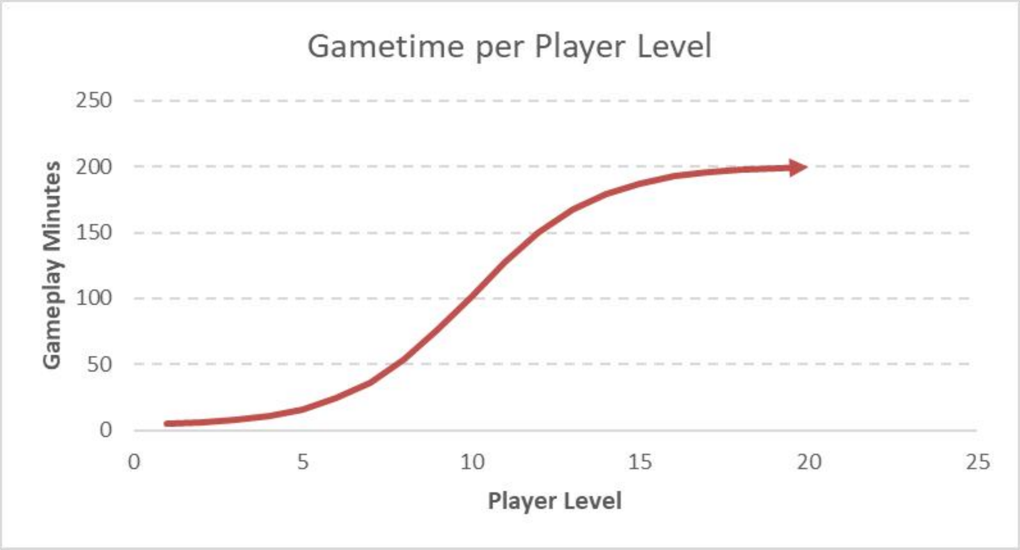
#: Design the Time for your Progression

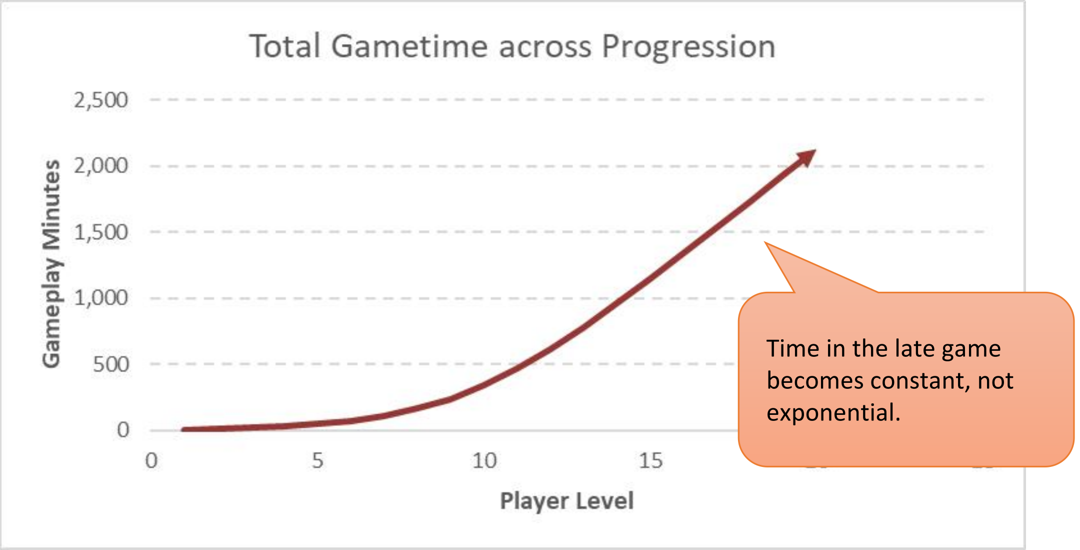
- Free-to-Play games should be balanced around the *feeling of fulfillment and constant progress*.
  - See *Idle Games* for extreme but super-effective versions of how constant reward and progress can be addictive.
- Hence, *purposefully design* the amount of Time in the game players will need getting to your main Progression milestones.
  - Then balance systems to reach these goals.

Idea: use a Sigmoid (Logistic) function to calculate the increments in Time, which results in:

1. High-speed fulfillment in the beginning.
2. Ramp up of time only in mid-game.
3. Constant time in the advanced levels, so even elder players continue to reach new milestones at a relatively constant pace.

$$f(x) = \frac{L}{1 + e^{-k(x-x_0)}}$$

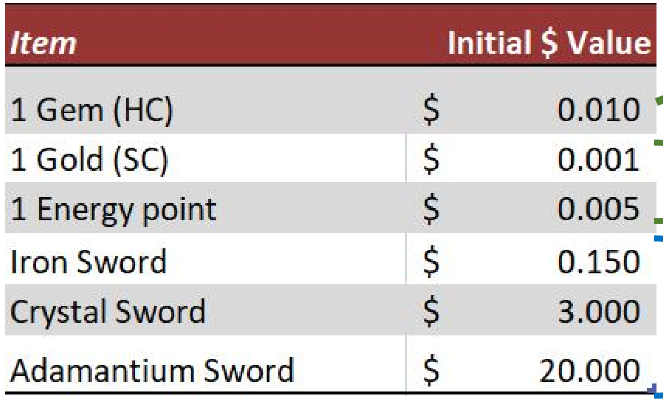




Time in the late game becomes constant, not exponential.

#: Model the value of your Resources in dollars.

- Initial value can be modeled against:
  - Impact in the game;
  - Intended granularity of the Resource in the game;
  - “Feeling” of what it should cost or what would be more intuitive for your audience.
- Model for *all items*, including those not directly purchasable.
  - It will be useful in internal calculations and design of Bundle Packs.
- Example:



Item	Initial $ Value
1 Gem (HC)	$ 0.010
1 Gold (SC)	$ 0.001
1 Energy point	$ 0.005
Iron Sword	$ 0.150
Crystal Sword	$ 3.000
Adamantium Sword	$ 20.000

Direct Purchase.

Indirectly purchased with Gems.

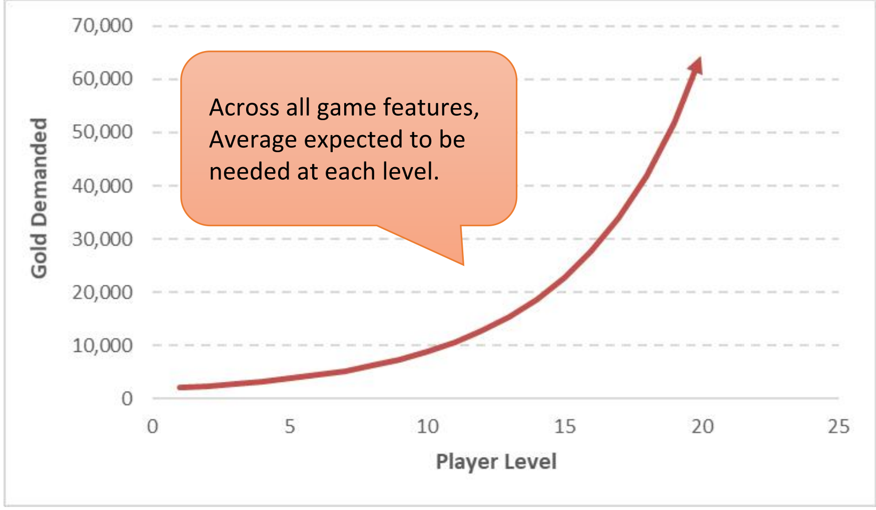
Normally only in loot and Treasure Chests.

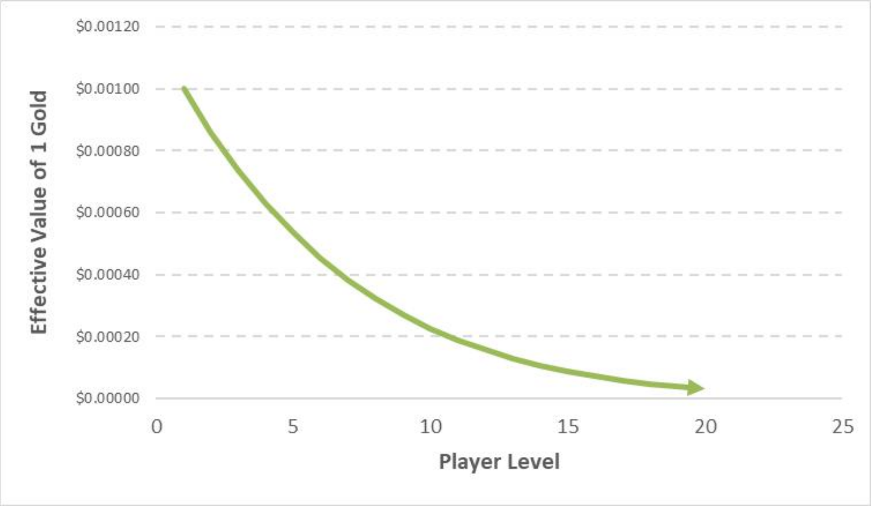
#: …but *effective value* change over time.

Suppose Gold (Soft-Currency) prices increase over progression exponentially.

- $ 1 of Gold will buy less and less **in-game Power**.
- Similar effect of classic Inflation, but for different structural reasons.
  - Instead of de-valuation due to oversupply of currency or excessive demand, it's because the game systems are just increasing difficulty and de-accelerating progression by taxing increments on **Power**.
- If 1 Gold = some Power = some Value, then the *effective value* of $ 1 of investment decreases by:

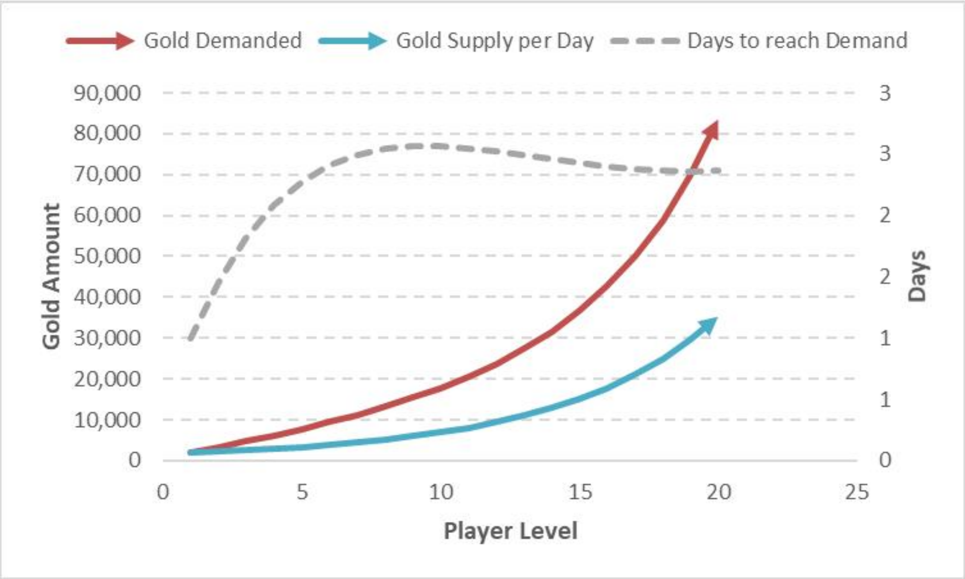
$$\frac{initialValue}{demanded_{currentLevel}} \times demanded_{level1}$$

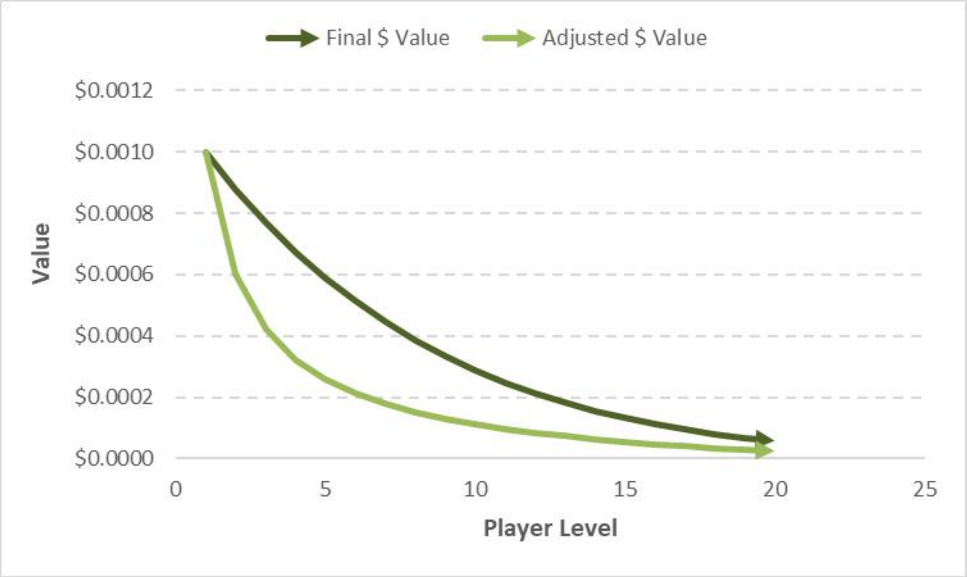

Across all game features, Average expected to be needed at each level.



- But there’s also the amount of Gold supplied by the game itself.
  - Game modes, daily bonuses, time-limited events.
- The speed in which Gold is given usually increases slower than the demand of prices.
  - Increasing the amount of time to accumulate the currency at each progression level.
  - Creating natural pressure on players to spend more time, more sessions or more money to keep progressing.
- The relative scarcity of Gold between what players need and what players get increases the *effective value* and the devaluation is less than if considering demand only.

$$\frac{\left(\frac{daysForDemand_{currentLevel}}{daysForDemand_{level1}} \times initialValue\right)}{demanded_{currentLevel}} \times demanded_{level1}$$

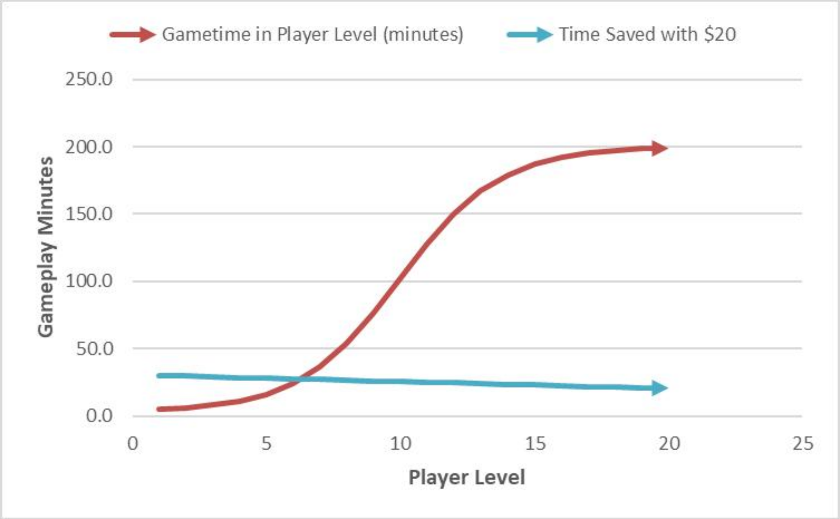


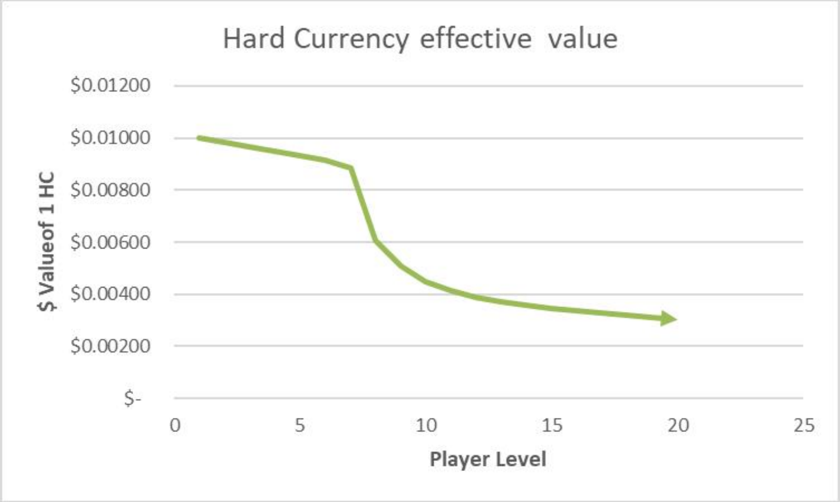


#: Balancing Hard-Currency, it's about Time

- Their value in terms of shortcutting Time tend to remain relatively stable (or *should…*)
- But *some* de-valorization occur, as things like build timer skips, energy purchases and progression difficulty bring down the effectiveness of 1 Hard-Currency.
- We can model the *effective value* over time with some compensation accounting for the *relative need* of the player increasing over time.

$$\frac{\left(\frac{timeSaved_n}{timeSaved_{n0}}\right)}{\log_e\left(MAX\left(gametime_n, timeSaved_n\right) - timeSaved_n + 1\right)} \times initialValue$$



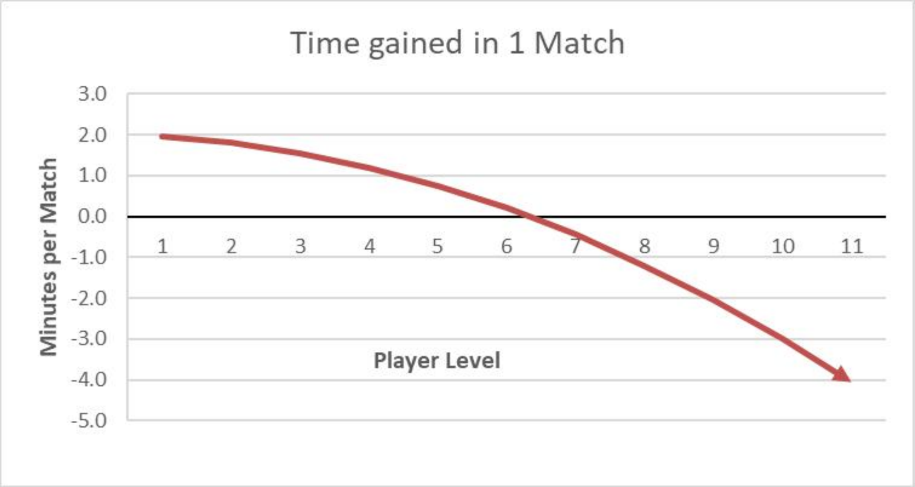


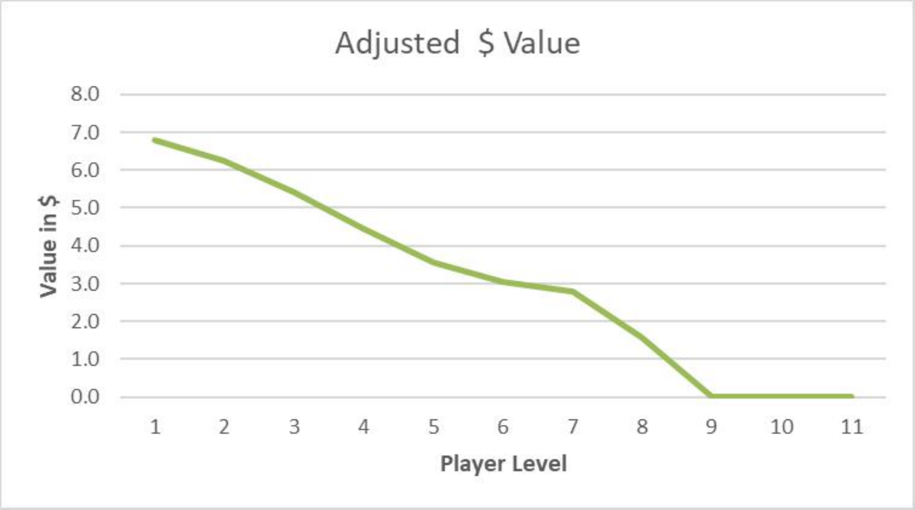
#: Balancing Items, it's about performance

- Consider the former Crystal Sword for $ 3.
- By using this weapon, considering its power level, how much Time per Match do you save?
- In the beginning it's really strong, with an effective value higher than the attributed price.
- But eventually, the weapon becomes weak and it costs *more* time to continue to use it than to change it.
  - the *effective value* drops all the way to zero.

$$MAX\left(0, (timeGained_n)^2 \times \frac{timeGained_n}{|timeGained_n|} + initialValue\right)$$

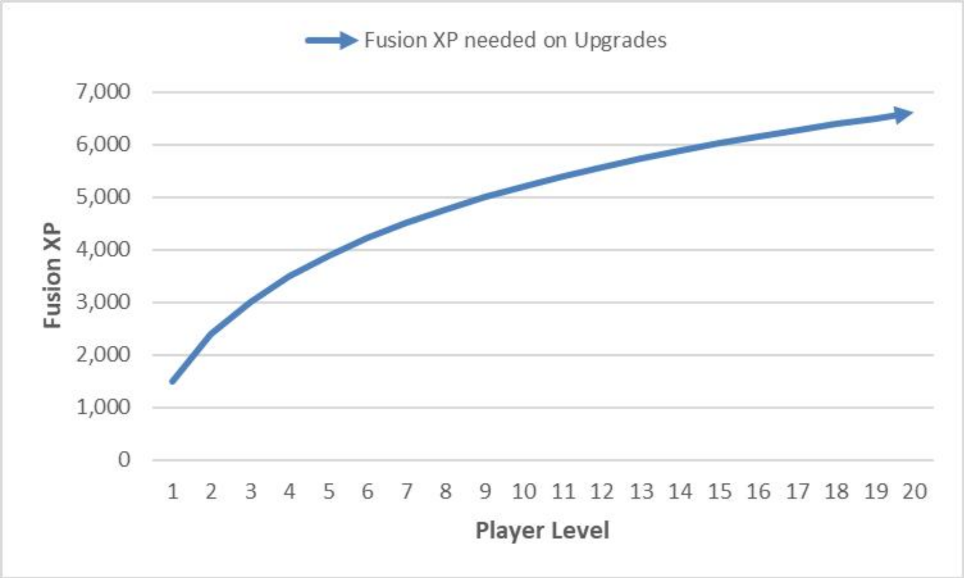
Only to get the original sign

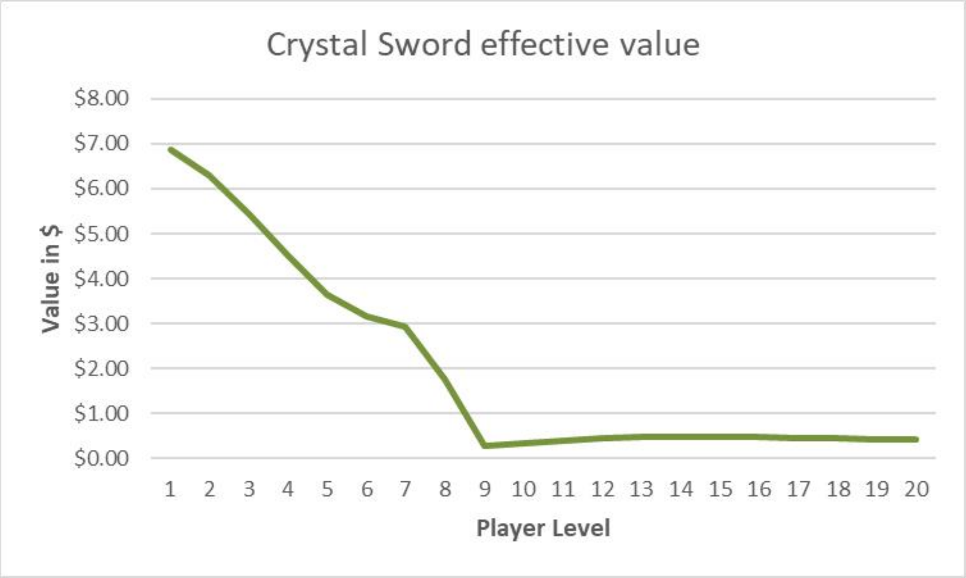




- *However*, if there is a "fusion system" in place…
  - A kind of system that consumes Items to boost/upgrade other Items.
  - Every item can be destroyed to give some "Fusion XP" to another item.
- Your progression design needs a general prediction of how much "Fusion XP" is needed on Item upgrades to keep going.
- We calculate a new effective value using:
  - Prediction of Fusion XP across project;
  - Amount of Fusion XP the Crystal Sword is worth;
  - Hard-Currency calculations from before.

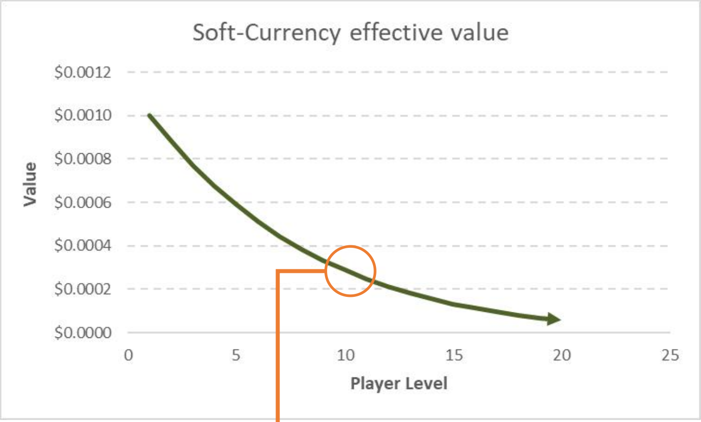
$$adjustedValue + \frac{\left(\frac{timeSaved_n}{timeSaved_{n0}}\right)}{\$20} \times \left(\frac{fusionXPSword}{\left(\frac{fusionXPNeeded_n}{gametime_n}\right)}\right)$$

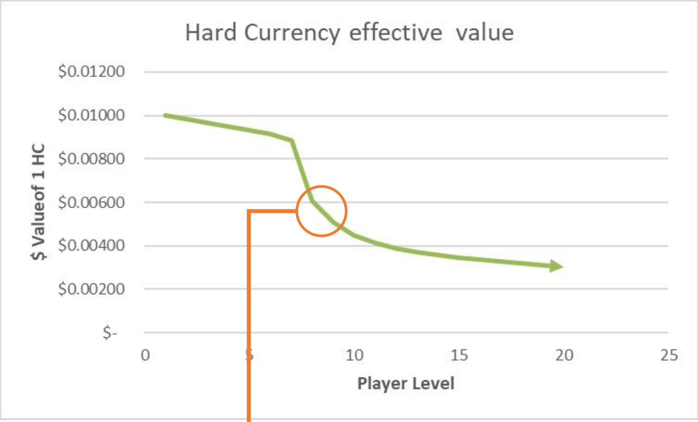


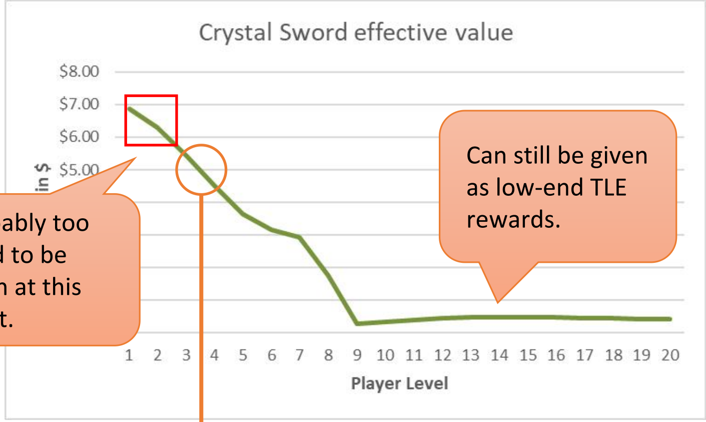


#: Create Bundle Packs and Events rewards with *effective value*

- Effective value helps you set how much to give as extra items in Bundle Packs or as rewards in Events and daily bonuses.







Probably too good to be given at this point.

Can still be given as low-end TLE rewards.

For a $50 Bundle Pack aimed at players of level 10, we can add 170k

For a $1-value reward aimed at players of level 8, we give 160 Gems

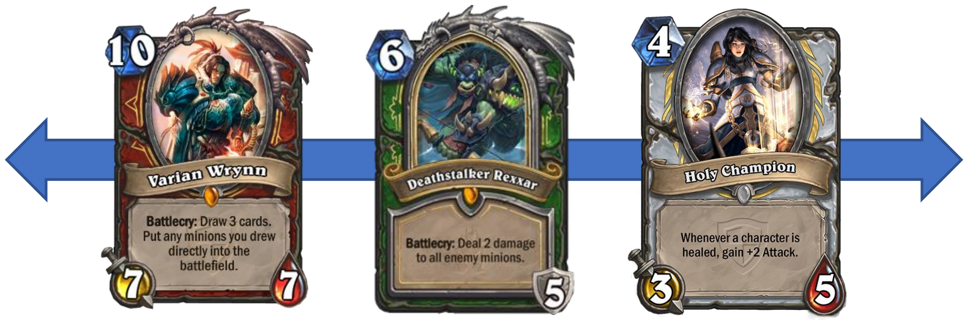
Excellent point for a Starter Pack, effective value is double of “regular”.

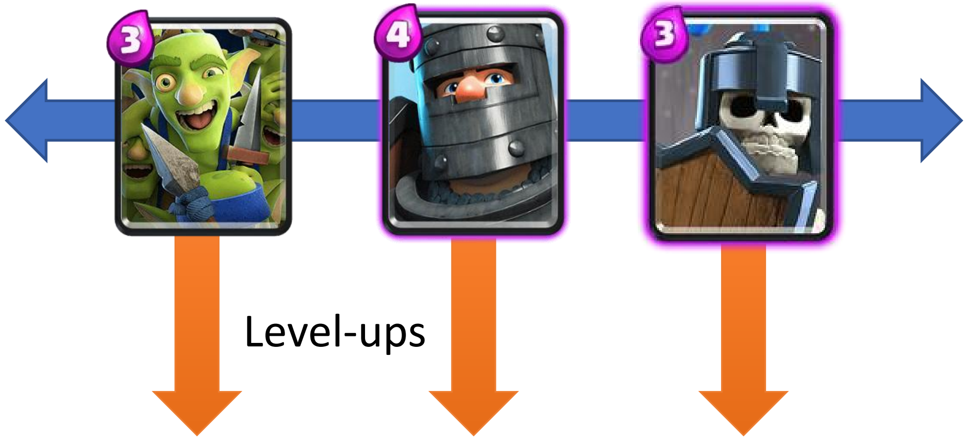
#: Design for Depth

- Depth around your main / most expensive assets will help on Live Ops sustainability and ROI.

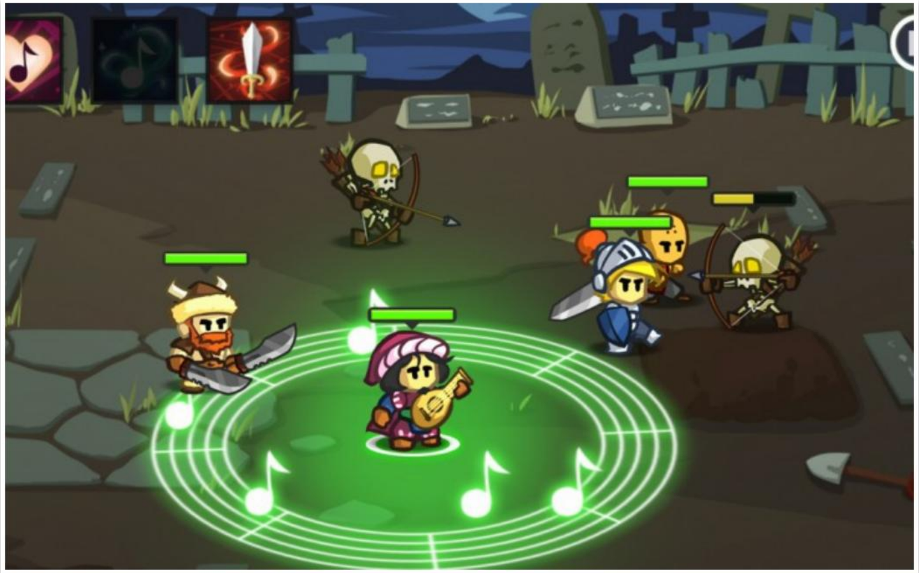
- Horizontal systems, where assets have unique effects, require more frequent updates and expensive asset-creation.

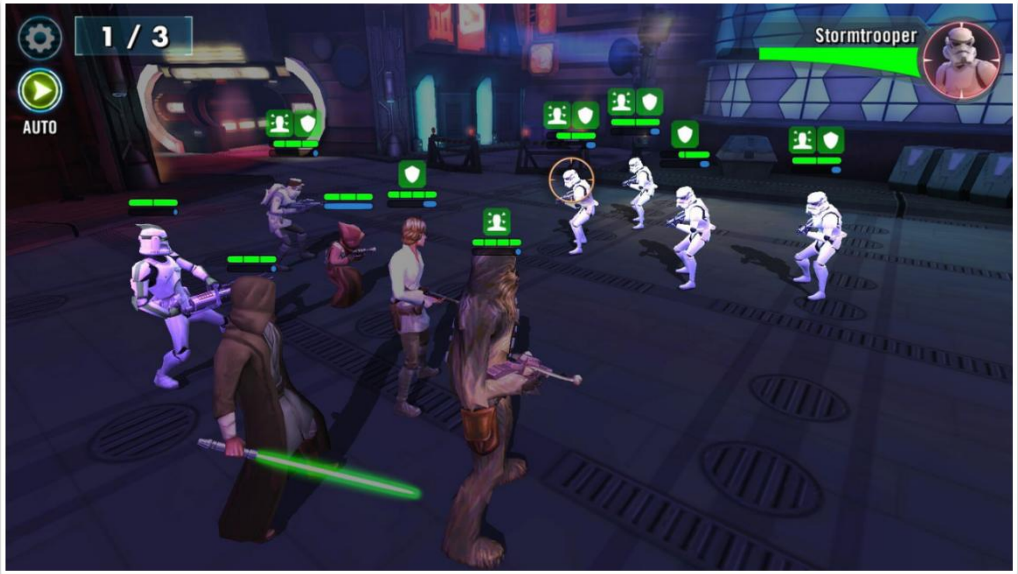
- Vertical systems, where assets are stats-based, allow to extend the useful life of assets with high production cost attached (art, tech, design, balancing, QA)


10
Varian Wrynn
Battlecry: Draw 3 cards. Put any minions you drew directly into the battlefield.
7
7
6
Deathstalker Rexxar
Battlecry: Deal 2 damage to all enemy minions.
5
4
Holy Champion
Whenever a character is healed, gain +2 Attack.
3
5



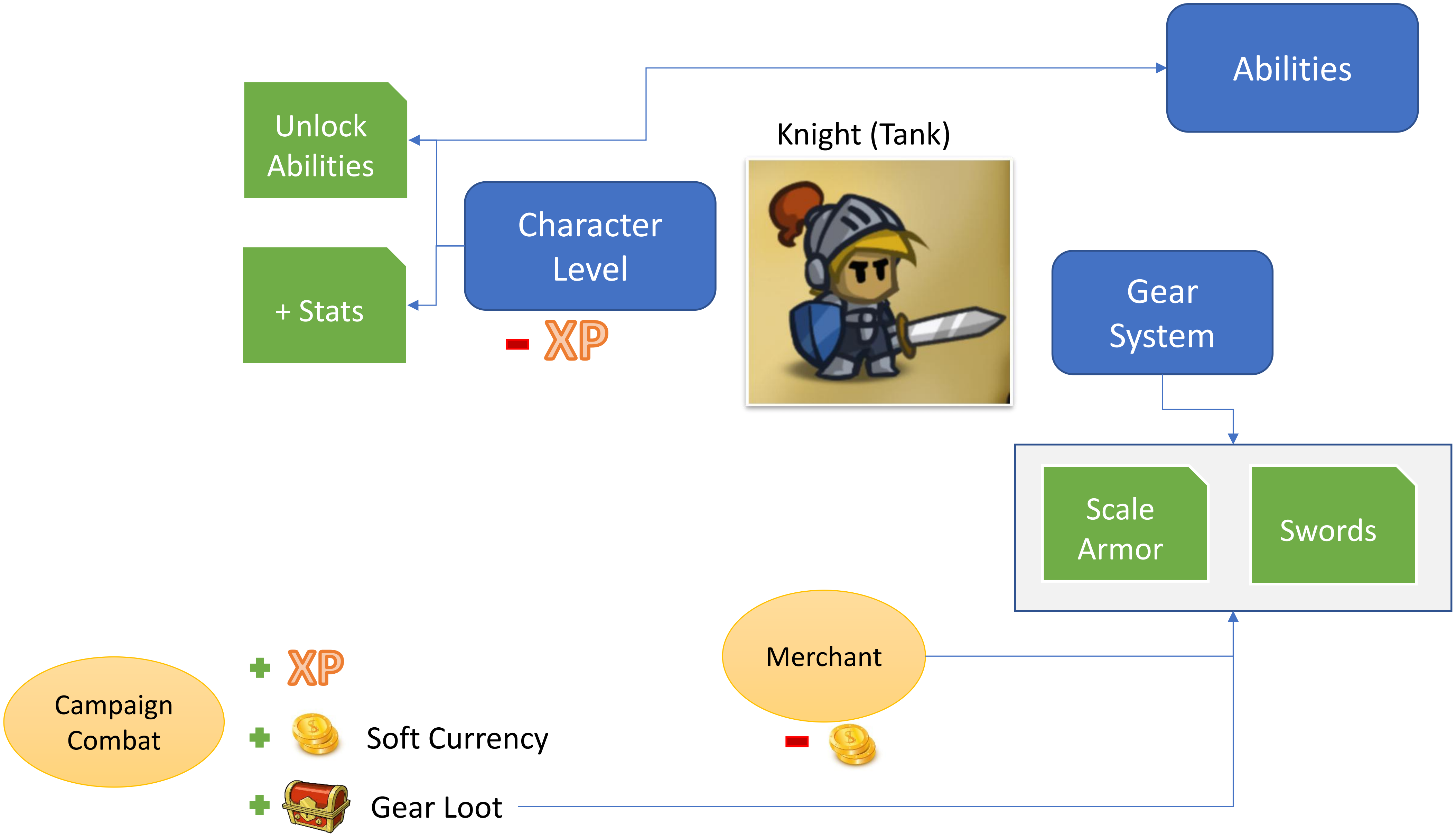
Battleheart vs. Galaxy of Heroes



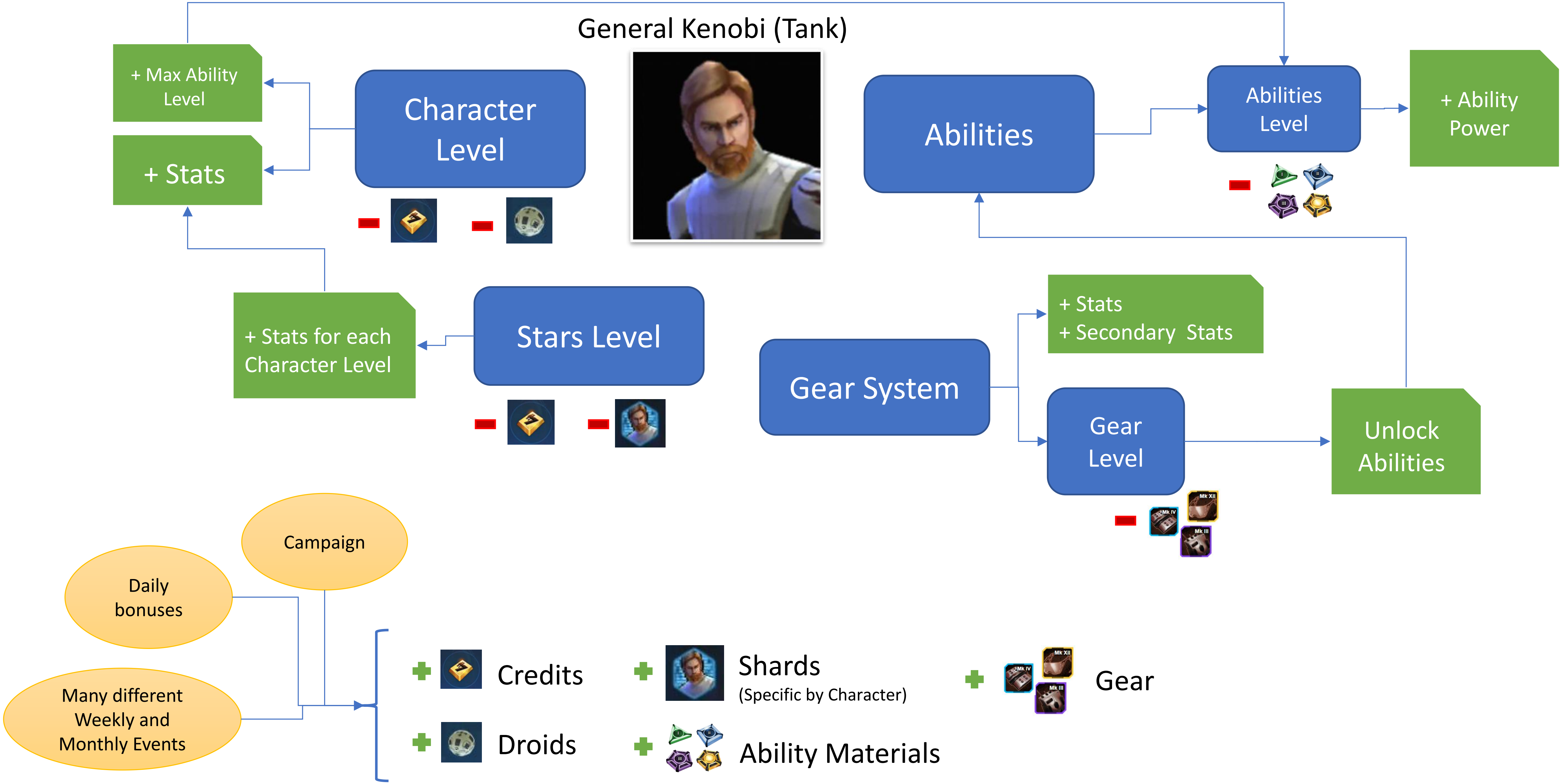


RPG games with groups of heroes using unique
Abilities + gear system + upgrade systems.

Battleheart's Hero Systems



Galaxy of Heroes’ Hero Systems



General Kenobi (Tank)

+ Max Ability Level

+ Stats

Character Level

Stars Level

+ Stats for each Character Level

Abilities

Abilities Level

+ Ability Power

Gear System

+ Stats
+ Secondary Stats

Gear Level

Unlock Abilities

Campaign

Daily bonuses

Many different Weekly and Monthly Events

Credits

Droids

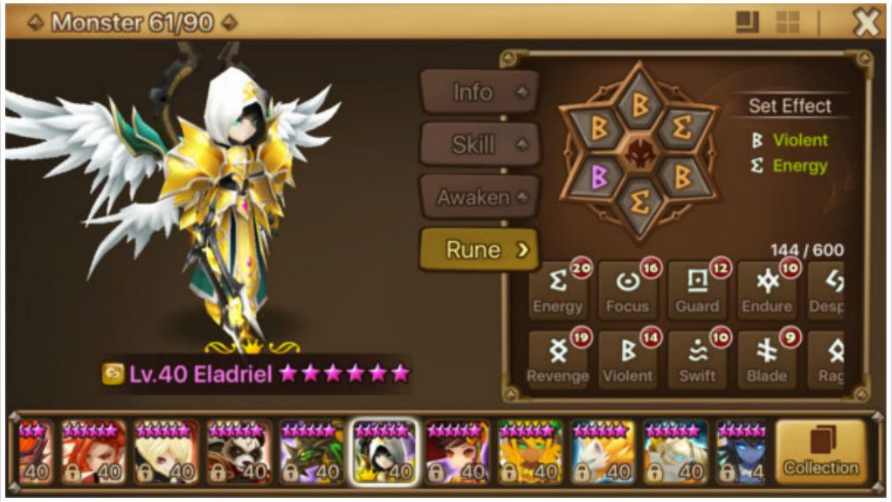
Shards
(Specific by Character)

Ability Materials

Gear

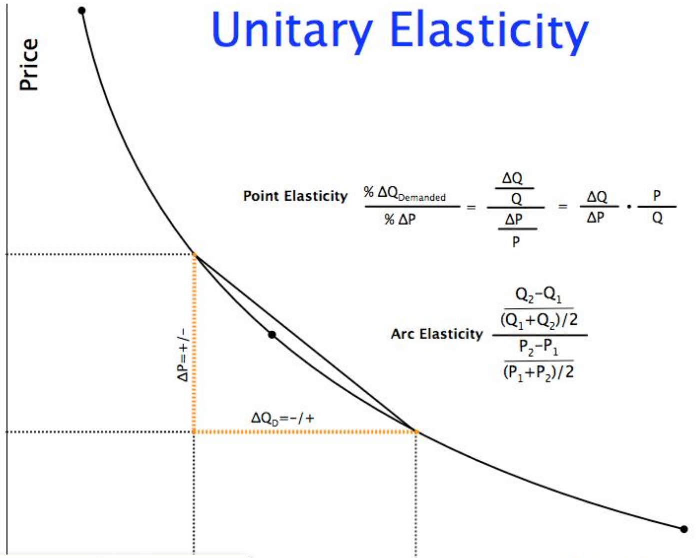
#: Asset Depth opens up for more Live Ops

- Specialization systems opens up for more emergent meta game.
- Also the extra resources enable more varied rewards for different Events
- Reduces the risk of power creep or nerfs in updates.
  - More orthogonal systems give designers more tools to solve imbalances in the gameplay.



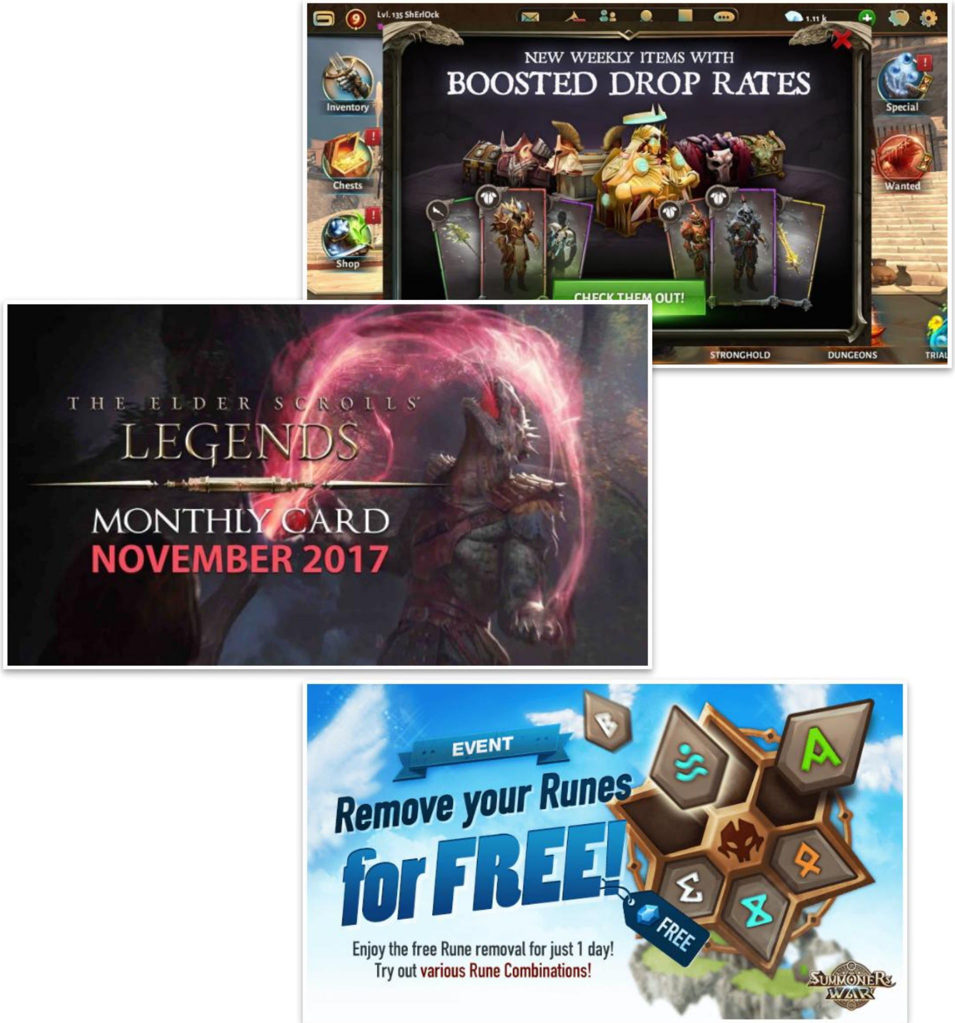
#: Cosmetic items are more of a classic Economics problem.

- We’re talking about **Cosmetic** effects:
    - Get an item not for its power, but for its looks.
- Ask players, do surveys.
- Classic price-elasticity problem.
    - Soft-launch / AB test to find the ones most coveted.
    - Evaluate charging more for them or making them harder to unlock.
- Watch how much players invest on them as a percentage of their *free* currency earned through Progression.
    - Not from purchased currency.
    - Players spending *free* currency in cosmetics will tell you how much time the item is worth.



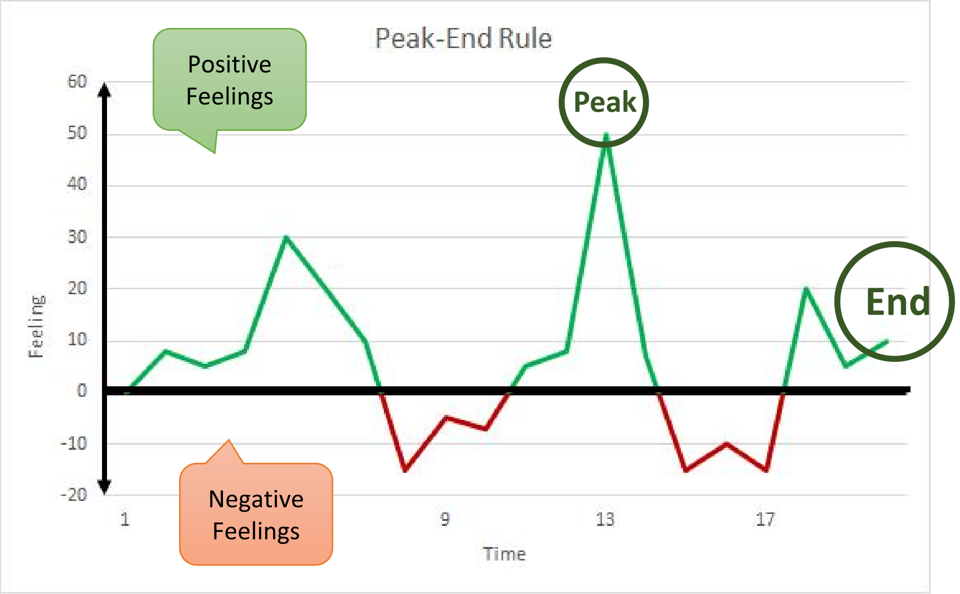
#: Consider real-time-locked resources

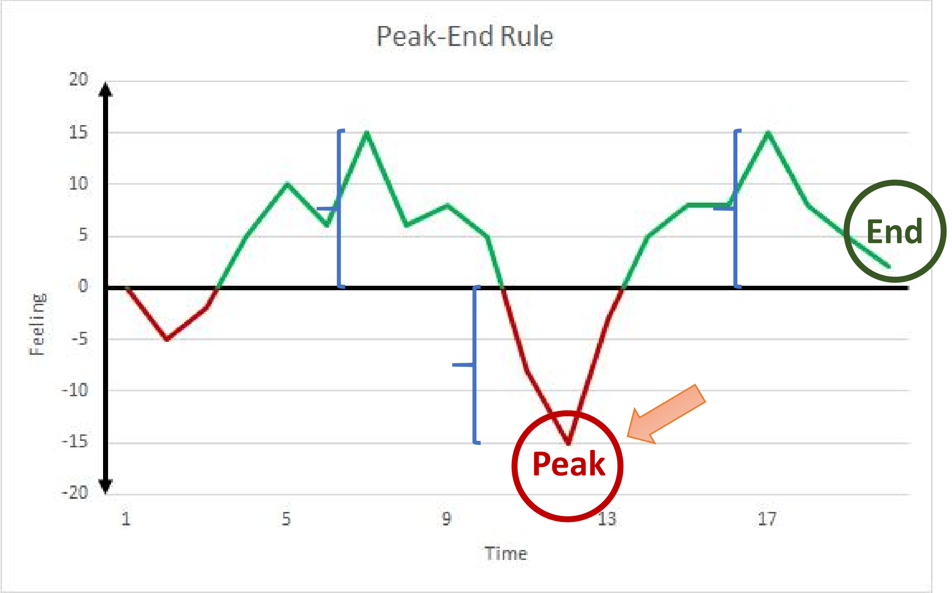
- Resources than can only be earned in specific intervals of time.
  - Materials that can only be obtained in a specific day of the week or the month.
  - Can be tied in any existing Season/Ladder reset.
- Examples:
  - The monthly free rune unsocketing day in Summoners War.
  - Weekly Fusion Boosters in Dungeon Hunter 5.
- Have more control over a part of the player's Progression and the Metagame.
- Can boost daily / monthly engagement as players come back just for those events with unique / hard to obtain rewards.



#: Use the Peak-End Rule

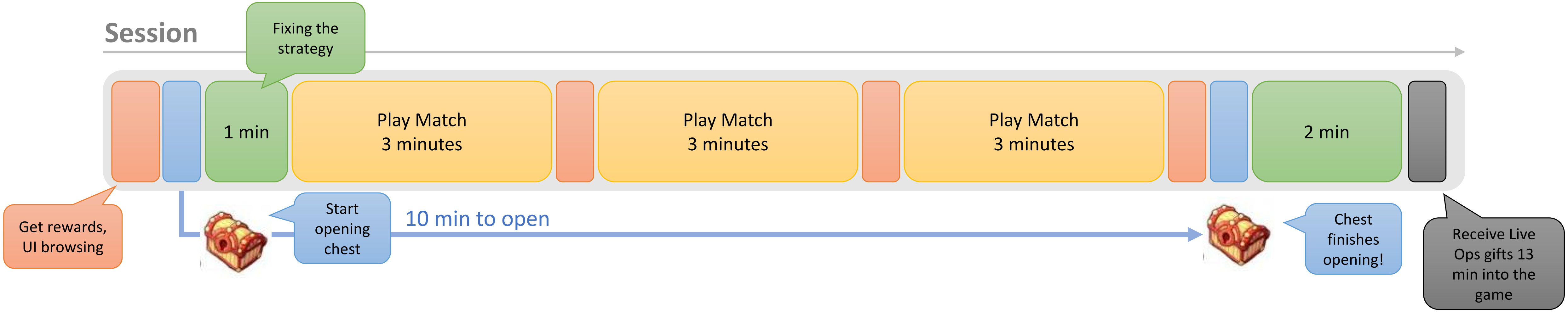
- *"The peak–end rule is a psychological heuristic in which people judge an experience largely based on how they felt at its peak (i.e., its most intense point) and at its end."* - Wikipedia
- Same rule apply both to positive and negative experiences:
  - If the peaks or ends are negatives, the experience is reminded as negative.
- **The End is stronger than the Peak.**
  - Experiences with a positive Peak but a negative End has a greater chance of being remembered as *negative*.
- Due to **negativity-bias**, negative experiences are more impactful.
  - Positive experiences need to be a lot better than the negative ones to override.





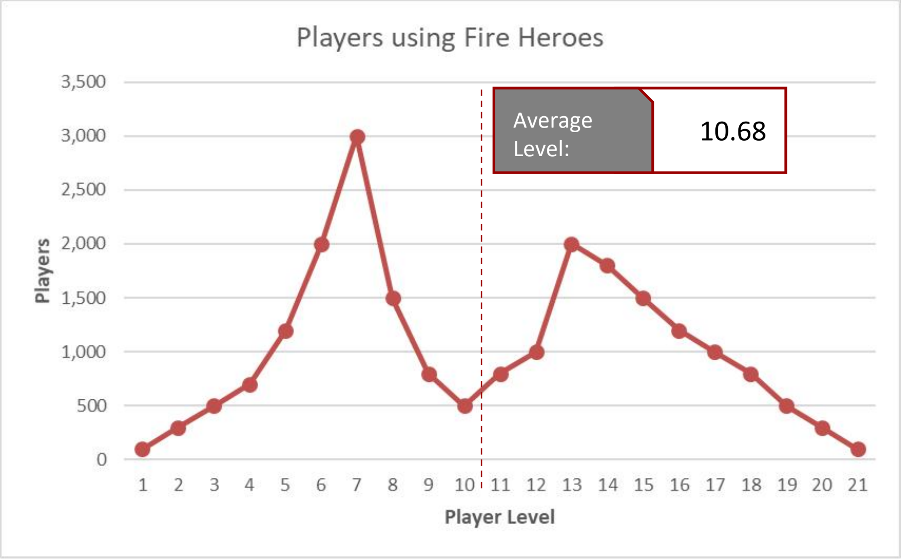
Strategize around potential Exit Points

- You can’t fully control positive and negative perception of your game.
- But you ***can*** try to make your game session end in a very rewarding way:
  - Design rewarding hooks next to potential Exit Points of your loop;
  - Set timers to set off in multiples of the expected duration of the main game loop.
  - Through your Live Ops systems, unlock game gifts at the end of the average session length;



#: On Live Ops, be careful with Averages

- Relying only on Averages might make you miss have *different populations* among your players.
    - Thus, miss design and business opportunities.
    - Do data exploration and scatter matrices when dealing with multiple dimensions.



- ➢ Averages would tell us Fire Heroes are more used around Level 10.
- ➢ But in fact, there’s a problem where they are ***less*** used at this point.

#: Common KPIs don't help designers

- Things like ARPU, Conversion, ARPPU, and even Retention are nice and good to know generally.
- But for designers, they are *not* real insights. They are "*trivia data*".
- If a designer during Live Ops is like a doctor trying to diagnose a patient:
    - Those KPIs are like thermometers.
    - But what doctors really like is to have blood tests and radiographies.

ARPPU

Conversion

K-factor

ARPU

CPI

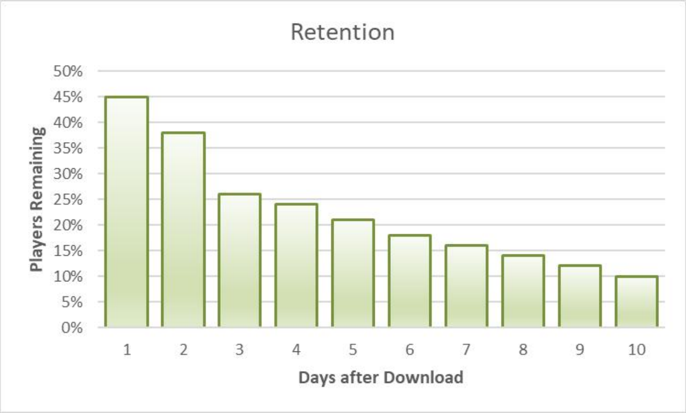
DAU

ARPDAU

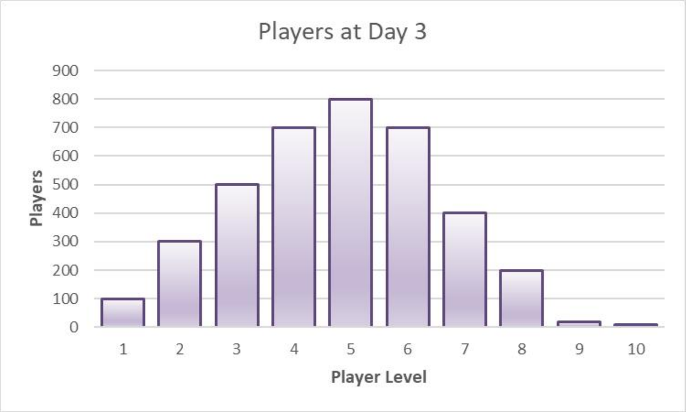
LTV

Retention

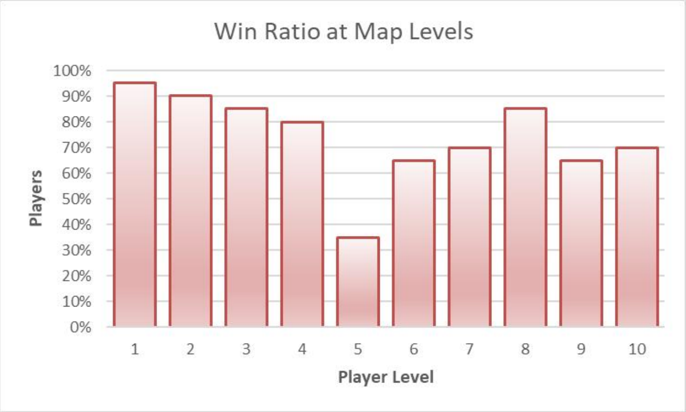
Exploring data to *really* help designers.



- ➢ Retention points to a problem in day 3. But why?



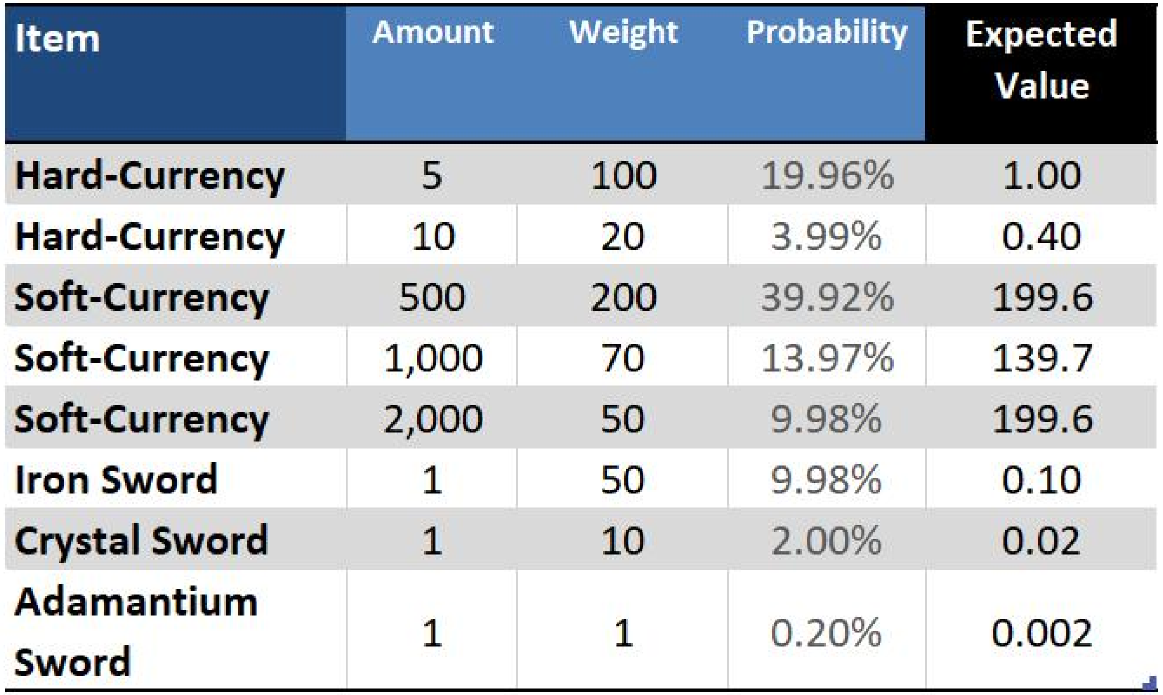
- ➢ Player Level tends to be 4-6 at day 3.
- ➢ What are they doing to drop?



- ➢ The win ratio of map level 5 is very *low*.
- ➢ We found a real insight that can help re-balancing.

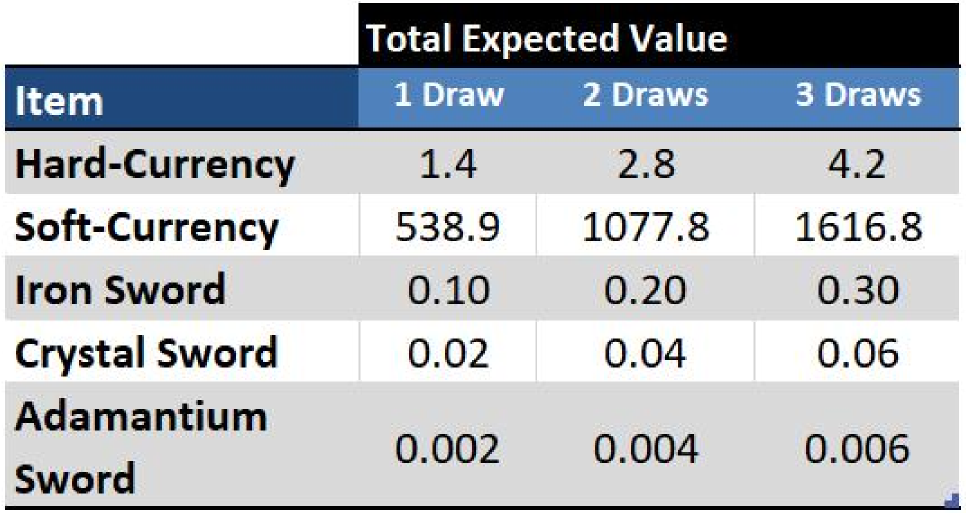
#: Expected Value to balance random systems.

- EV of an Item = (Probability of the item) X (Quantity)
- For example, consider the following Loot design:

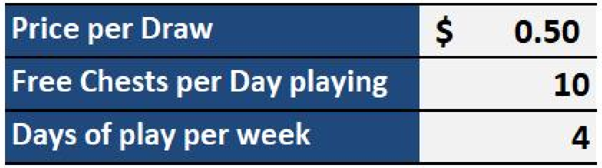


Item	Amount	Weight	Probability	Expected Value
Hard-Currency	5	100	19.96%	1.00
Hard-Currency	10	20	3.99%	0.40
Soft-Currency	500	200	39.92%	199.6
Soft-Currency	1,000	70	13.97%	139.7
Soft-Currency	2,000	50	9.98%	199.6
Iron Sword	1	50	9.98%	0.10
Crystal Sword	1	10	2.00%	0.02
Adamantium Sword	1	1	0.20%	0.002

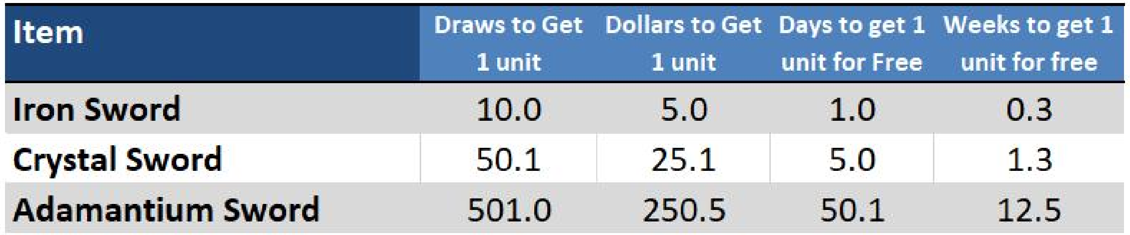
- As consecutive Chests are opened, you can just sum the Expected Values to Project what the player will earn on average:
- You can use the EV to balance how much to charge for a Chest – or how fast to give it for free.
- You can use the same concept for any other random system, like Enemy loot, probability to get Daily Bonuses, probability to get specific Daily Quests, etc.



	Total Expected Value		
Item	1 Draw	2 Draws	3 Draws
Hard-Currency	1.4	2.8	4.2
Soft-Currency	538.9	1077.8	1616.8
Iron Sword	0.10	0.20	0.30
Crystal Sword	0.02	0.04	0.06
Adamantium Sword	0.002	0.004	0.006



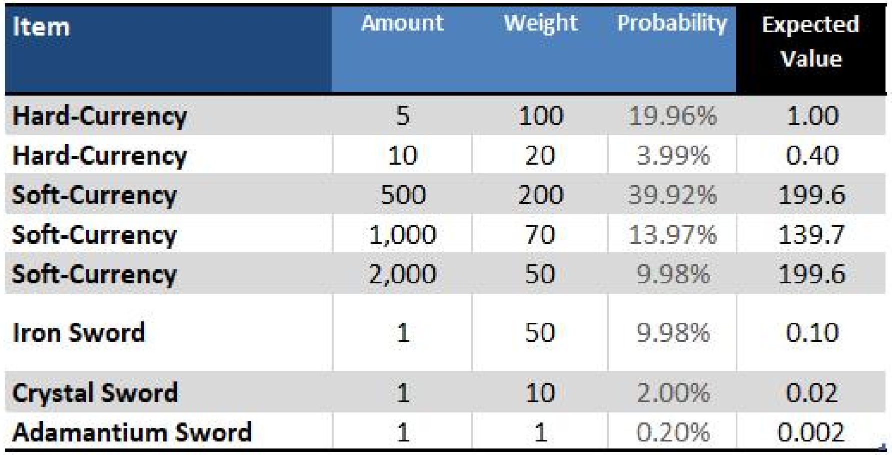
Price per Draw	$ 0.50
Free Chests per Day playing	10
Days of play per week	4



Item	Draws to Get 1 unit	Dollars to Get 1 unit	Days to get 1 unit for Free	Weeks to get 1 unit for free
Iron Sword	10.0	5.0	1.0	0.3
Crystal Sword	50.1	25.1	5.0	1.3
Adamantium Sword	501.0	250.5	50.1	12.5

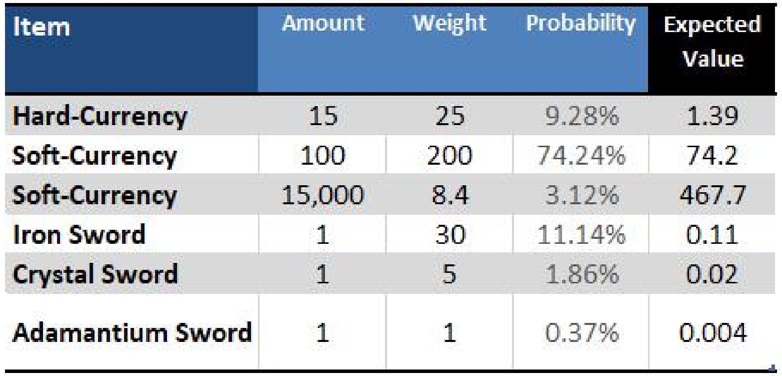
But as I said, be careful with Averages!

- Obsessing only with the “right” Expected Value can blind you for how the feature is actually distributed and *fun* for players to use.

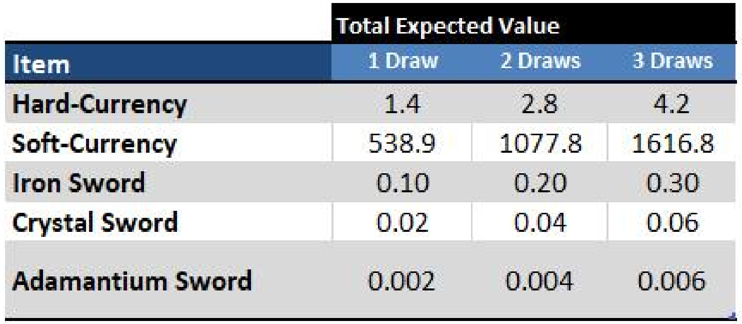


Item	Amount	Weight	Probability	Expected Value
Hard-Currency	5	100	19.96%	1.00
Hard-Currency	10	20	3.99%	0.40
Soft-Currency	500	200	39.92%	199.6
Soft-Currency	1,000	70	13.97%	139.7
Soft-Currency	2,000	50	9.98%	199.6
Iron Sword	1	50	9.98%	0.10
Crystal Sword	1	10	2.00%	0.02
Adamantium Sword	1	1	0.20%	0.002

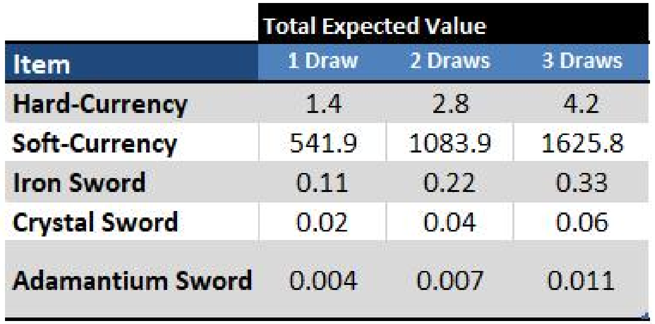
Vs.



Item	Amount	Weight	Probability	Expected Value
Hard-Currency	15	25	9.28%	1.39
Soft-Currency	100	200	74.24%	74.2
Soft-Currency	15,000	8.4	3.12%	467.7
Iron Sword	1	30	11.14%	0.11
Crystal Sword	1	5	1.86%	0.02
Adamantium Sword	1	1	0.37%	0.004



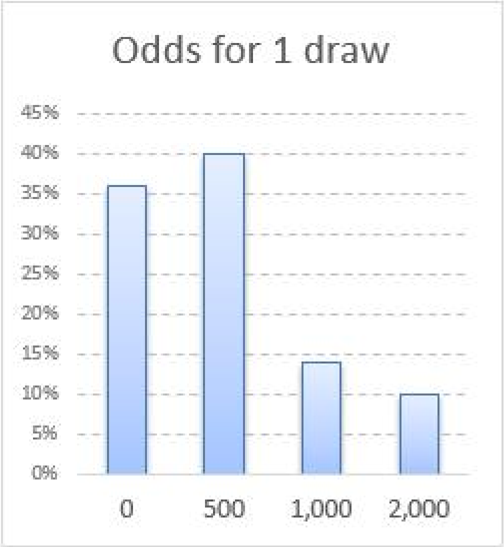
	Total Expected Value		
Item	1 Draw	2 Draws	3 Draws
Hard-Currency	1.4	2.8	4.2
Soft-Currency	538.9	1077.8	1616.8
Iron Sword	0.10	0.20	0.30
Crystal Sword	0.02	0.04	0.06
Adamantium Sword	0.002	0.004	0.006

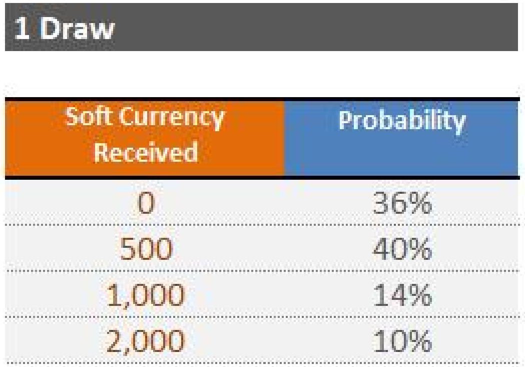


	Total Expected Value		
Item	1 Draw	2 Draws	3 Draws
Hard-Currency	1.4	2.8	4.2
Soft-Currency	541.9	1083.9	1625.8
Iron Sword	0.11	0.22	0.33
Crystal Sword	0.02	0.04	0.06
Adamantium Sword	0.004	0.007	0.011

#: Design around outliers created by your random systems.

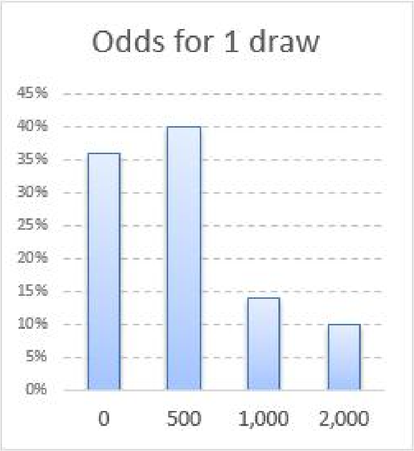
- Every geometric random system like the loot chest described before generates **outliers –** users who get too much or too little, out of sheer chance.
- Consider the odds of how much Soft-Currency our Chest gives in 1 draw:

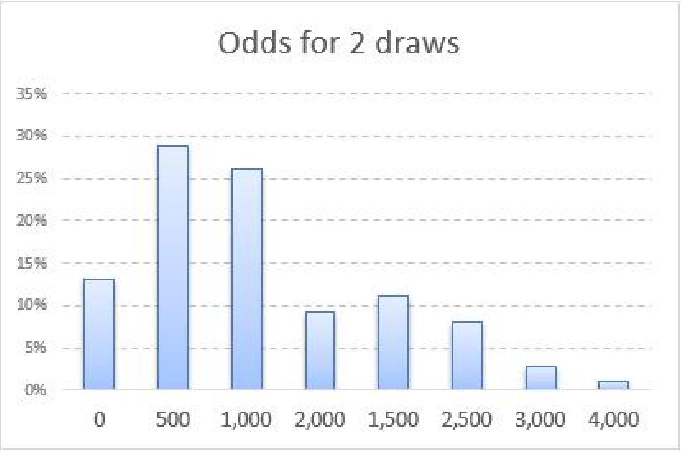



1 Draw

Soft Currency Received	Probability
0	36%
500	40%
1,000	14%
2,000	10%

- As we calculate the probable amount of Soft-Currency for drawing **2** times, the shape of our distribution starts to change.


Odds for 1 draw


Odds for 2 draws

1 Draw

Soft Currency Received	Probability
0	36%
500	40%
1,000	14%
2,000	10%

2 Draws

Soft Currency Received	Initial Probability	Conditional Probability	Amount Earned in 2 Draws
0	36%	13.1%	0
500	40%	14.4%	500
1,000	14%	5.0%	1,000
2,000	10%	3.6%	2,000
0	36%	14.4%	500
500	40%	15.9%	1,000
1,000	14%	5.6%	1,500
2,000	10%	4.0%	2,500
0	36%	5.0%	1,000
500	40%	5.6%	1,500
1,000	14%	2.0%	2,000
2,000	10%	1.4%	3,000
0	36%	3.6%	2,000
500	40%	4.0%	2,500
1,000	14%	1.4%	3,000
2,000	10%	1.0%	4,000

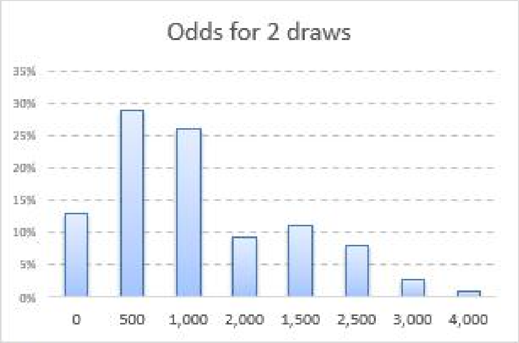
Outcomes at the 2nd draw ***given that*** the first draw was 0

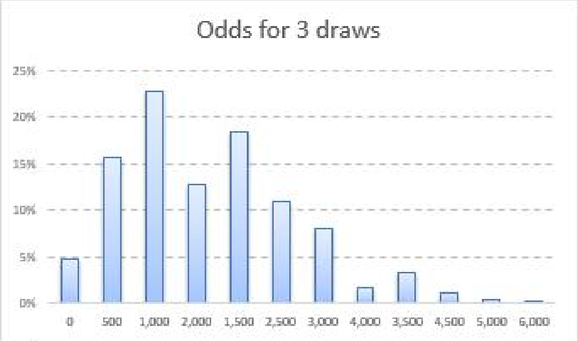
Outcomes at the 2nd draw ***given that*** the first draw was 500

Outcomes at the 2nd draw ***given that*** the first draw was 1000

Outcomes at the 2nd draw ***given that*** the first draw was 2000

- Continue to evaluate drawing 3 times…





A pattern is emerging in the joint probability as we draw more…

2 Draws

Soft Currency Received	Initial Probability	Conditional Probability	Earned in 2 Draws
0	36%	13.1%	0
500	40%	14.4%	500
1,000	14%	5.0%	1,000
2,000	10%	3.6%	2,000
0	36%	14.4%	500
500	40%	15.9%	1,000
1,000	14%	5.6%	1,500
2,000	10%	4.0%	2,500
0	36%	5.0%	1,000
500	40%	5.6%	1,500
1,000	14%	2.0%	2,000
2,000	10%	1.4%	3,000
0	36%	3.6%	2,000
500	40%	4.0%	2,500
1,000	14%	1.4%	3,000
2,000	10%	1.0%	4,000

3 Draws

Soft Currency Received	Initial Probability	Conditional Probability	Earned in 3 Draws
0	36%	4.72%	0
500	40%	5.21%	500
1,000	14%	1.82%	1,000
2,000	10%	1.30%	2,000
0	36%	5.21%	500
500	40%	5.76%	1,000
1,000	14%	2.02%	1,500
2,000	10%	1.44%	2,500
0	36%	1.82%	1,000
500	40%	2.02%	1,500
1,000	14%	0.71%	2,000
2,000	10%	0.50%	3,000
0	36%	1.30%	2,000
500	40%	1.44%	2,500
1,000	14%	0.50%	3,000
2,000	10%	0.36%	4,000
0	36%	5.21%	500
500	40%	5.76%	1,000
1,000	14%	2.02%	1,500
2,000	10%	1.44%	2,500
0	36%	5.76%	1,000
500	40%	6.36%	1,500
1,000	14%	2.23%	2,000
2,000	10%	1.59%	3,000

Outcomes at the 3rd draw ***given that*** the 1st draw was 0 and the 2nd was 0

Outcomes at the 3rd draw ***given that*** the 1st draw was 0 and the 2nd was 500

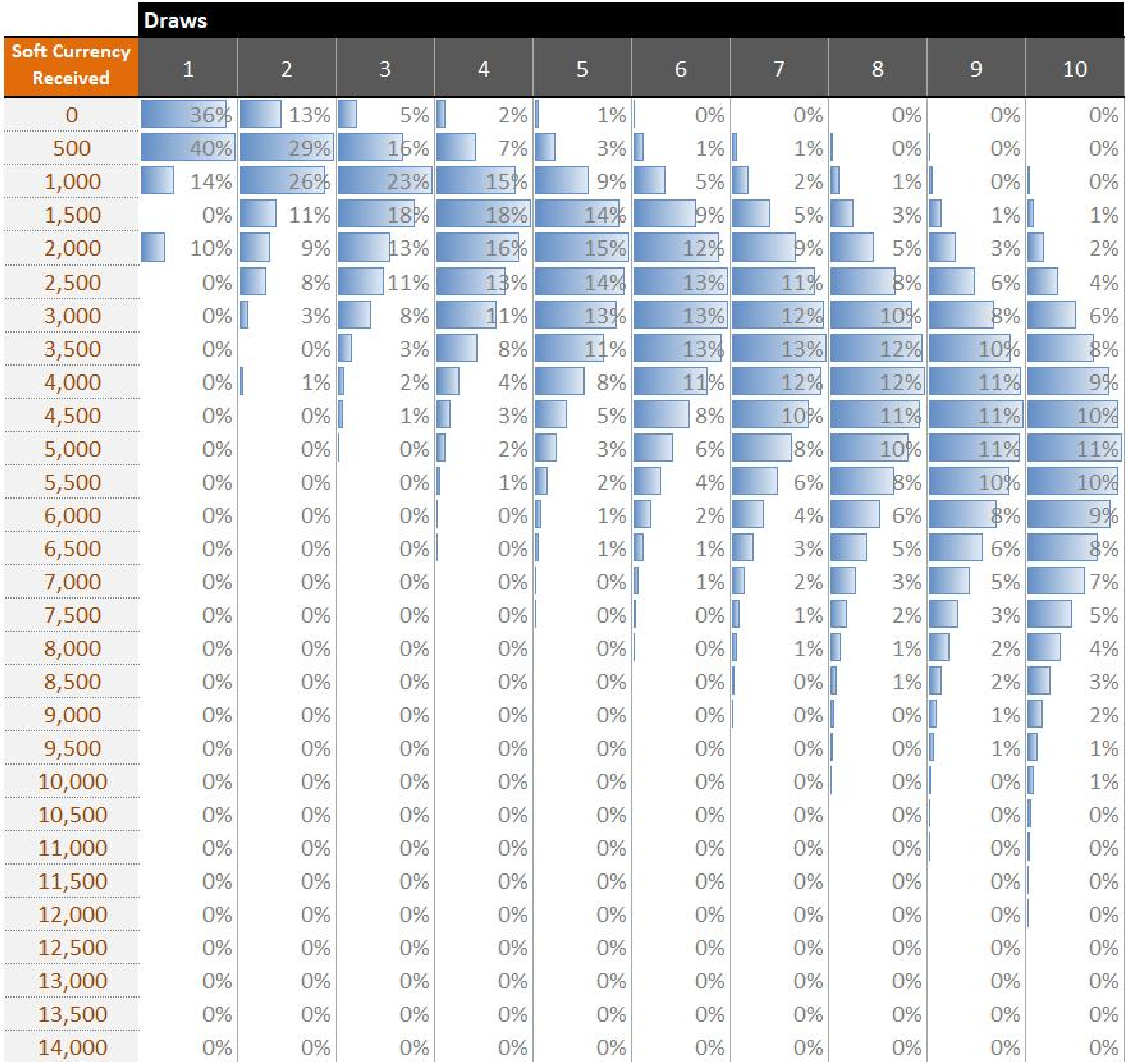
Outcomes at the 3rd draw ***given that*** the 1st draw was 0 and the 2nd was 1000

Outcomes at the 3rd draw ***given that*** the 1st draw was 0 and the 2nd was 2000

Outcomes at the 3rd draw ***given that*** the 1st draw was 500 and the 2nd was 0

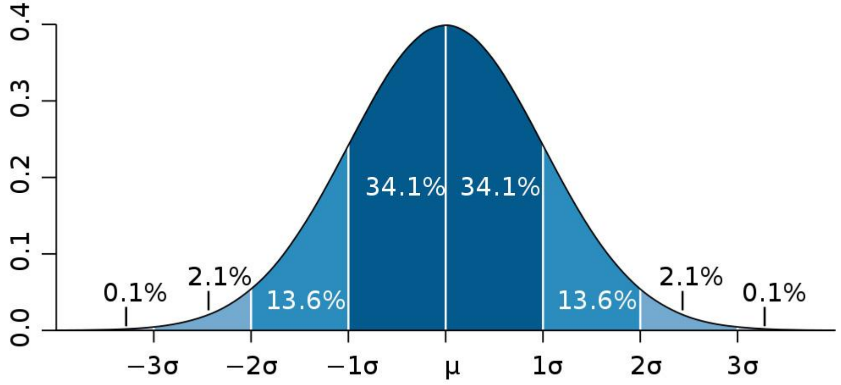
Outcomes at the 3rd draw ***given that*** the 1st draw was 500 and the 2nd was 500

…etc…



Soft Currency Received	Draws 1	2	3	4	5	6	7	8	9	10
0	36%	13%	5%	2%	1%	0%	0%	0%	0%	0%
500	40%	29%	16%	7%	3%	1%	1%	0%	0%	0%
1,000	14%	26%	23%	15%	9%	5%	2%	1%	0%	0%
1,500	0%	11%	18%	18%	14%	9%	5%	3%	1%	1%
2,000	10%	9%	13%	16%	15%	12%	9%	5%	3%	2%
2,500	0%	8%	11%	13%	14%	13%	11%	8%	6%	4%
3,000	0%	3%	8%	11%	13%	13%	12%	10%	8%	6%
3,500	0%	0%	3%	8%	11%	13%	13%	12%	10%	8%
4,000	0%	1%	2%	4%	8%	11%	12%	12%	11%	9%
4,500	0%	0%	1%	3%	5%	8%	10%	11%	11%	10%
5,000	0%	0%	0%	2%	3%	6%	8%	10%	11%	11%
5,500	0%	0%	0%	1%	2%	4%	6%	8%	10%	10%
6,000	0%	0%	0%	0%	1%	2%	4%	6%	8%	9%
6,500	0%	0%	0%	0%	1%	1%	3%	5%	6%	8%
7,000	0%	0%	0%	0%	0%	1%	2%	3%	5%	7%
7,500	0%	0%	0%	0%	0%	0%	1%	2%	3%	5%
8,000	0%	0%	0%	0%	0%	0%	1%	1%	2%	4%
8,500	0%	0%	0%	0%	0%	0%	0%	1%	2%	3%
9,000	0%	0%	0%	0%	0%	0%	0%	0%	1%	2%
9,500	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
10,000	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
10,500	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11,000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11,500	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
12,000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
12,500	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13,000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13,500	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14,000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

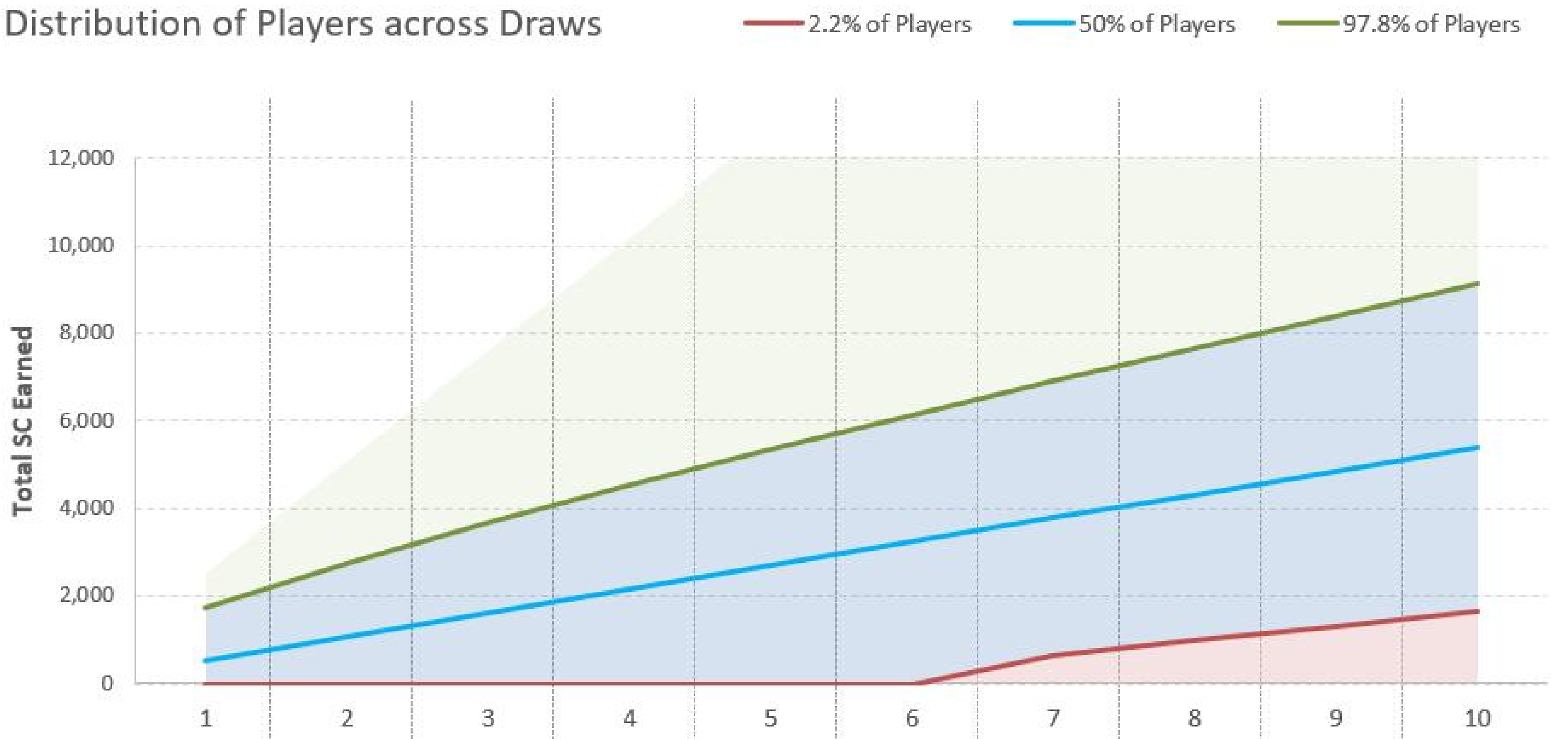
Normal Distribution!



- Geometrical systems *tend* to become Normal Distributions over time.
- We can then use the properties of Normal Distributions to evaluate our potential outliers.

Calculate how much SC your outliers have.

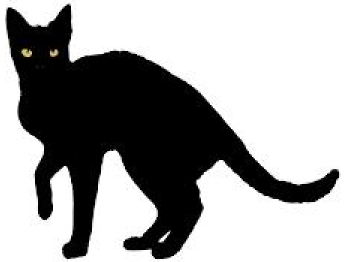
- Lucky players are > +2 Standard Deviations away from the mean.
- Unlucky ones, < -2 Standard Deviations.
- As they draw more Chests, the spread between them increases.



Mean	540	1,080	1,620	2,160	2,700	3,240	3,780	4,320	4,860	5,400
Maximum that the *bottom* 2.2% have	0	0	0	0	0	0	657	981	1,318	1,667
Minimum that the **top** 2.2% have	1,721	2,749	3,665	4,521	5,340	6,132	6,903	7,659	8,402	9,133
"Unlucky" Mean	0	0	0	0	0	0	443	449	898	1,346
"Lucky" Mean	2,000	3,263	4,360	5,346	5,959	7,004	7,575	8,588	9,154	10,164

How do you prevent too many outliers?

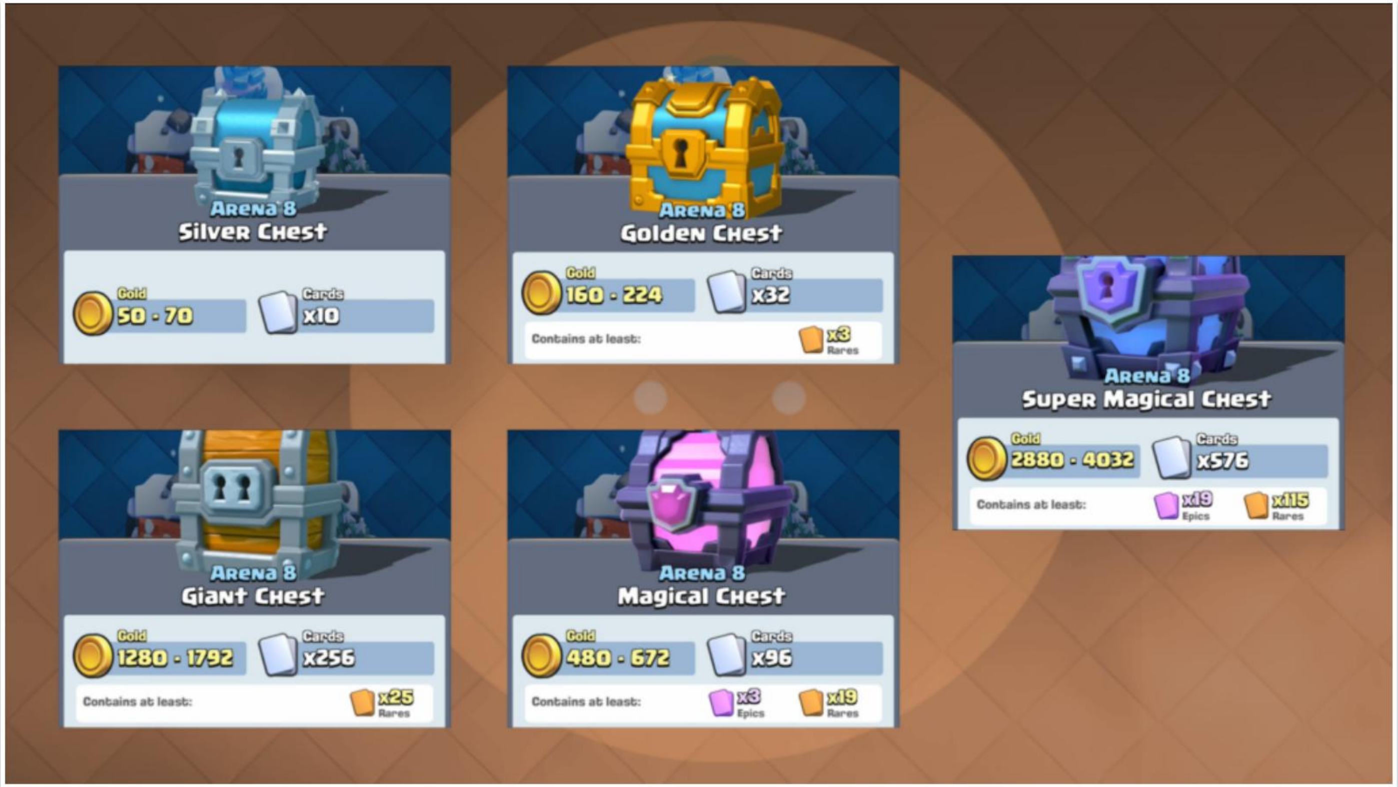
- Some players *will* be more lucky or unlucky.
  - Without this knowledge, when designing a loot system, you might think: “it’s OK if they get lucky”.
  - But what if they get **really unlucky**?
  - Generally, the amount of “lucky” players are the same as the “unlucky” ones!



- In free-to-play, this is a big problem if some of your ***paying users*** are in these populations.
  - They are either spending less than they should, or they will churn away in frustration.
- How does your game treat lottery outliers?
  - Is it balanced for them too?
  - Can it still be fun if you only have the SC the “unlucky” population got?
  - Do you have systems to prevent them from becoming too powerful or to churn away?

#: Guarantee certain draws / rarities

- Like in Clash Royale, a certain amount of Rare or better cards is guaranteed, and a certain range of resources too.



Arena 8
Silver Chest
Gold 50 - 70
Cards x10

Arena 8
Golden Chest
Gold 160 - 224
Cards x32
Contains at least: x3 Rares

Arena 8
Super Magical Chest
Gold 2880 - 4032
Cards x576
Contains at least: x19 Epics x115 Rares

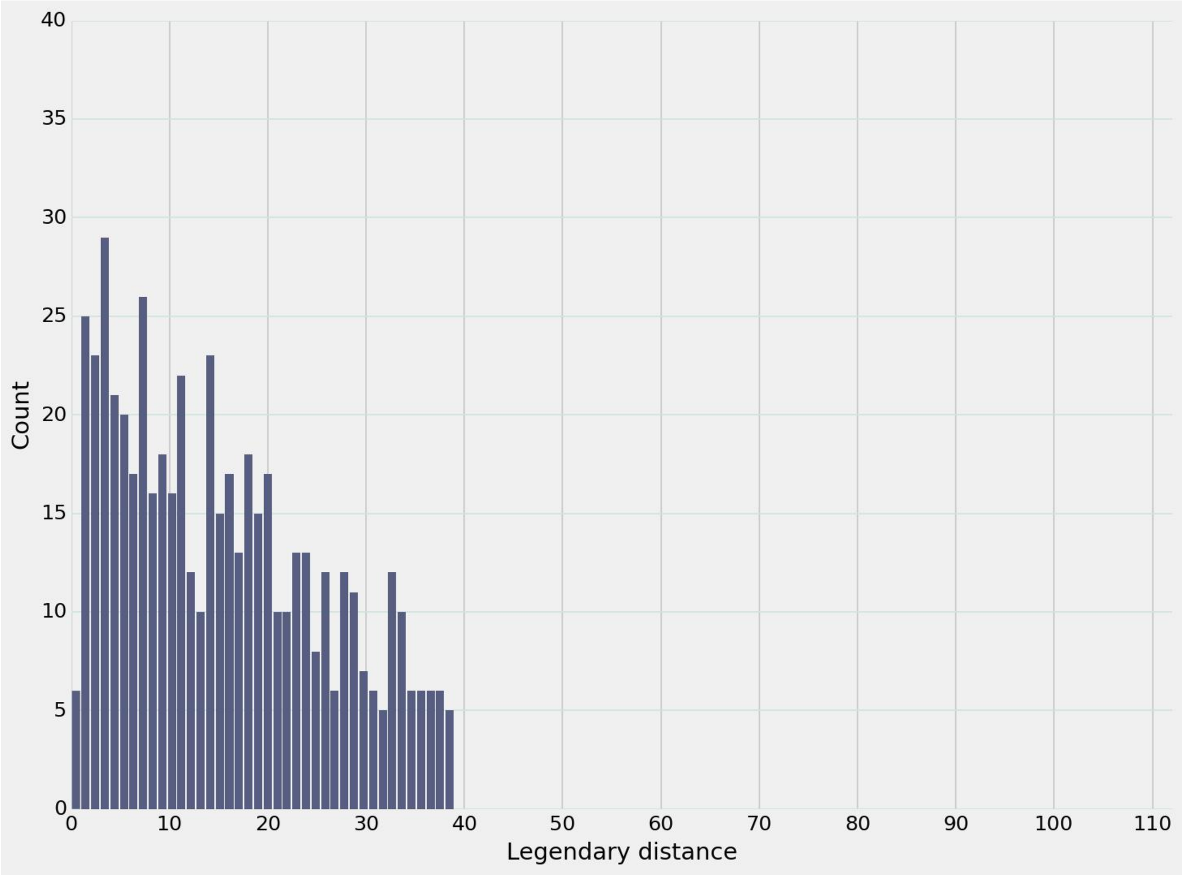
Arena 8
Giant Chest
Gold 1280 - 1792
Cards x256
Contains at least: x25 Rares

Arena 8
Magical Chest
Gold 480 - 672
Cards x96
Contains at least: x3 Epics x19 Rares

#: Pity timers

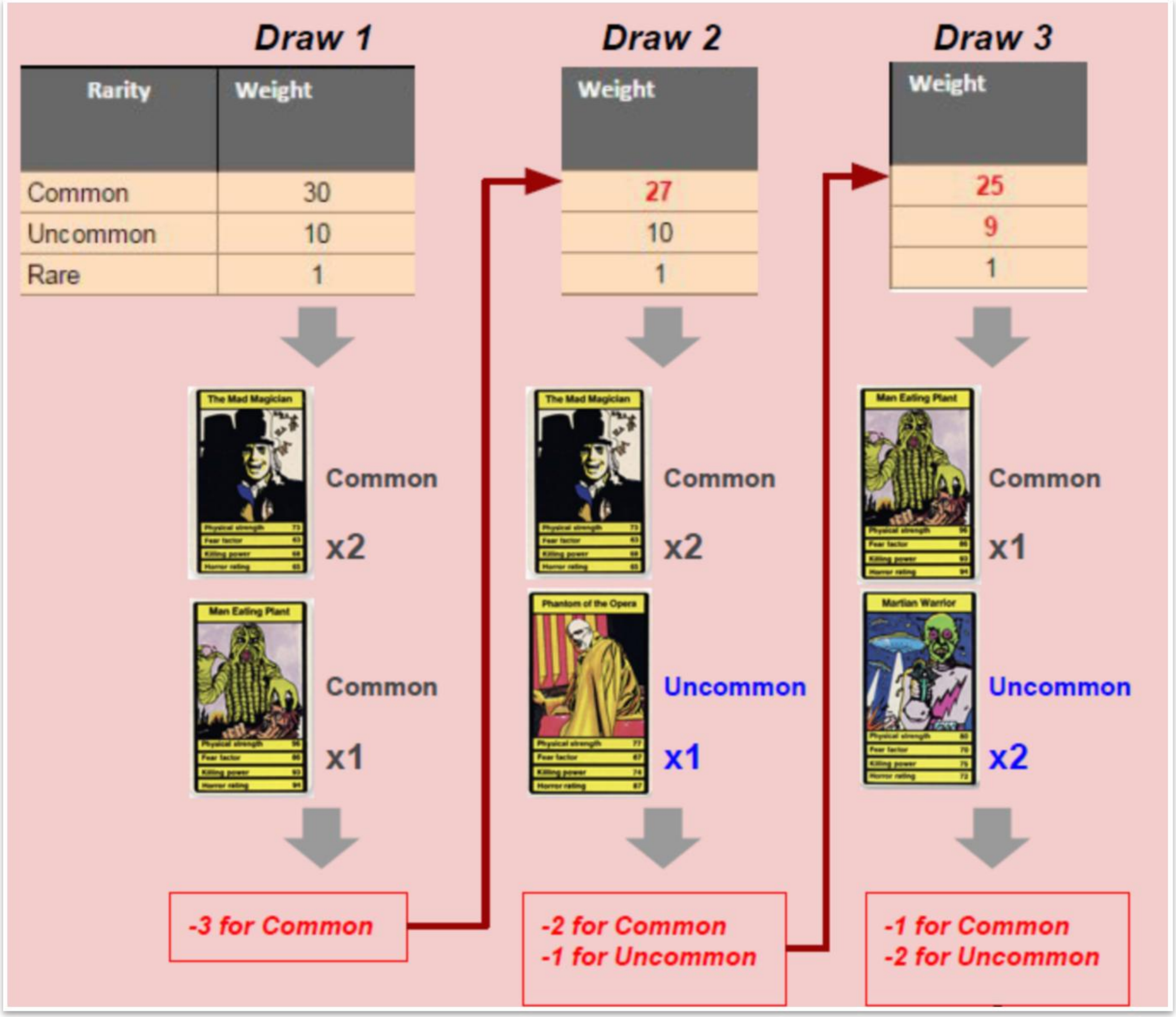
- Like in Hearthstone, if you open too many packs without a Legendary, your odds begin to change until you find one.

9
4
Hooded Acolyte
Whenever a character is healed, give your C'Thun +1/+1 (wherever it is).
3
Priest
4
Fandral Staghelm
Your Choose One cards have both effects combined.
3
Druid
4
Fandral Staghelm
Your Choose One cards have both effects combined.
3
5
Druid
Done



#: Consider a “bag of marbles” as a system

- Hypergeometrical, like a deck of cards.
    - Every time you draw a card of a certain rarity, -1 weight.
    - Once all weights are zero, restart.
- More certainty for the player.
    - On long-term, guarantees less outliers on the bottom.
- Problem of determinism.
    - Possibility of resetting the loot table with a certain condition of finding a rare item



Draw 1

Rarity	Weight
Common	30
Uncommon	10
Rare	1

Draw 2

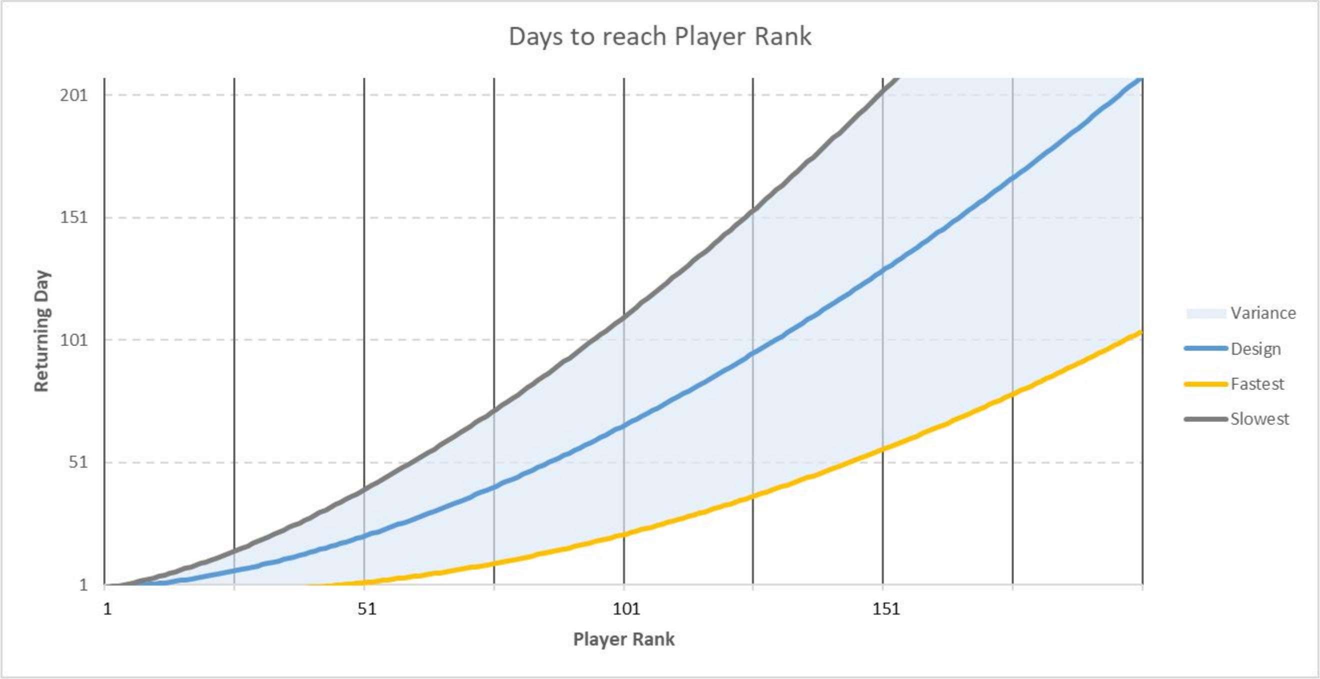
Weight
27
10
1

Draw 3

Weight
25
9
1

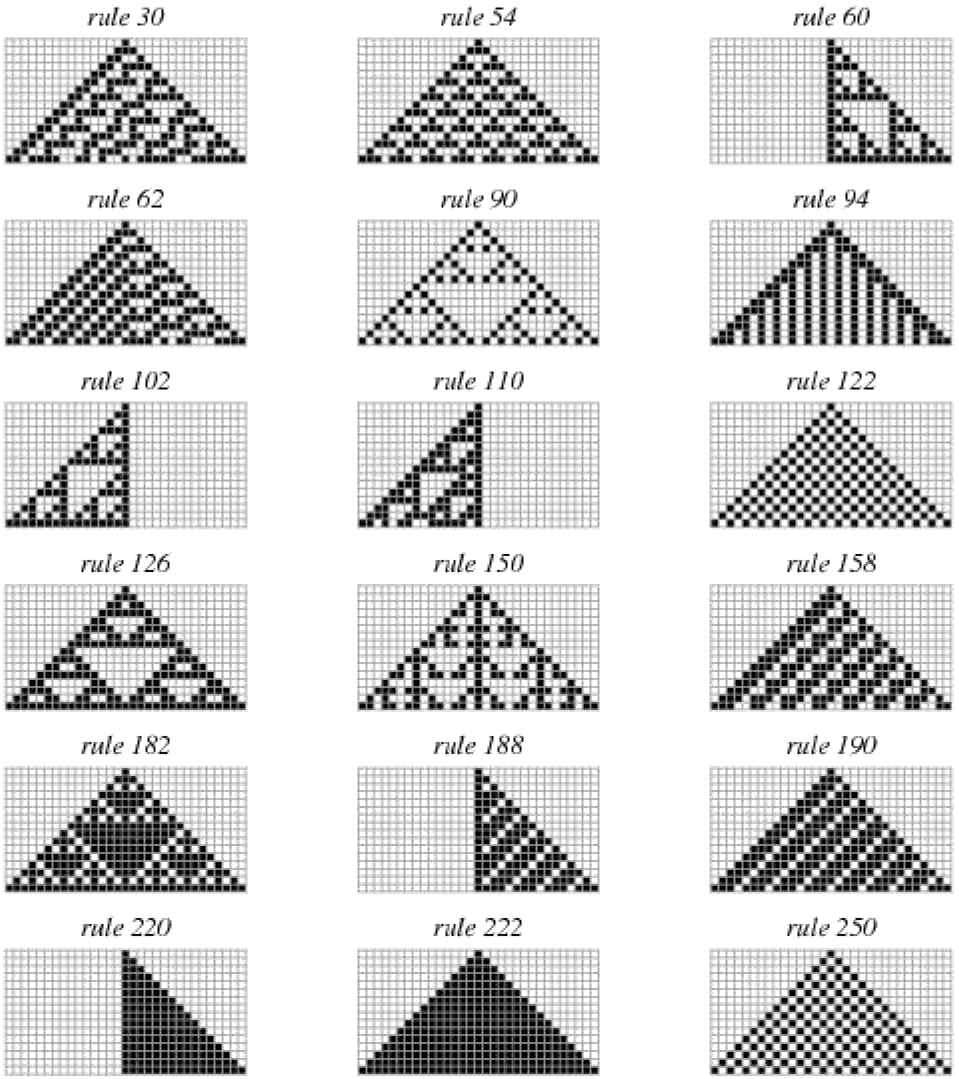
#: You can use this kind of EV / variance analysis for many types of resources.

- Example for reaching a certain Player Level:
- Users won't accumulate XP in the same pace – some will play more days, others will play less.



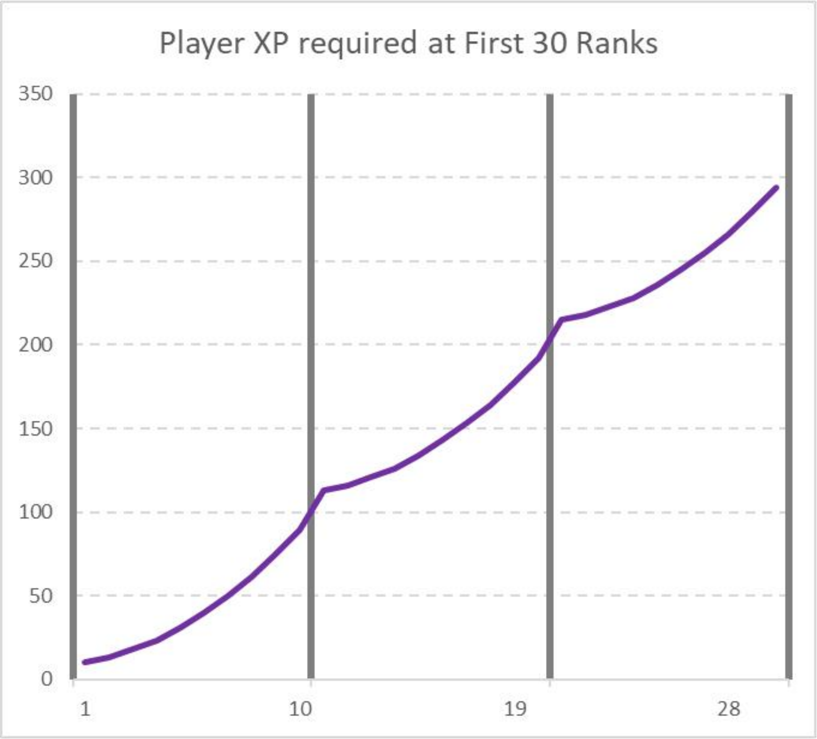
#: Program progression simulations to assess economic flow.

- Why?
- The Cellular Automaton problem – *emergent systems*
    - A strictly deterministic system with emergent behavior can still lead to unpredictable results, no matter how good is the algebra.
- Games are *emergent systems*:
    - Even with very deterministic systems, it’s very hard to “predict the metagame”.
    - Simulating the actual progression and decision-making of thousands of players can reveal a lot of “blind spots” you wouldn’t otherwise find until launching the game.
- If you have coding abilities.
    - Excel quickly gets very hard to scale.
    - Code will scale better with functions / classes / libraries / loops.



#: Prefer tables in the game over formulas

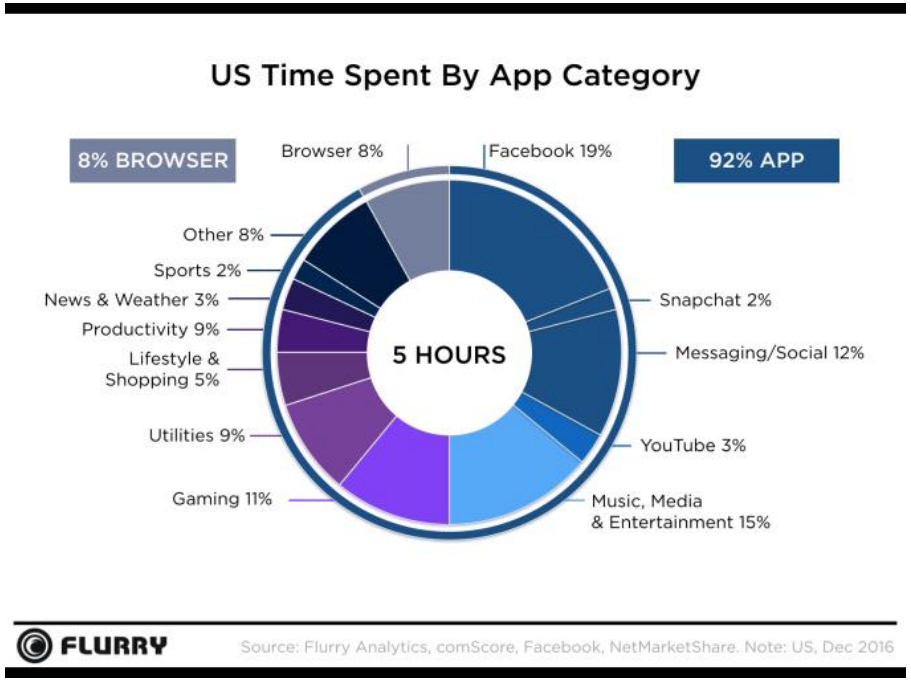
- Because you can do all kinds of fixes and special cases in your distributions.
  - Example: level-up curve with spikes of cost at “milestones” in multiples of 10.
  - **Easier to maintain for designers**, don’t need a programmer to just update the game database / config files.
  - Shapes that are hard or impossible to do with simple formulas.
- (But sometimes that’s not possible, like in Idle Games)



#: Understand how Social Media does it

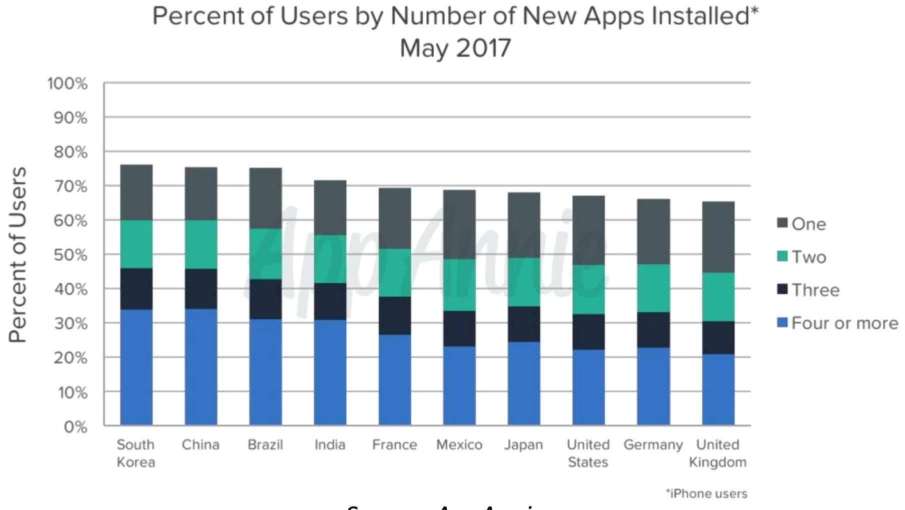
- On free-to-play mobile, we're competing mostly with Social Media
  - We're in the *attention economy*.
  - The amount of attention to new apps have been reducing considerably over time.
  - This time is being directed to Social Media.
  - People touch the phone 2617 times a day to check for messages + 76 longer sessions.

- *Highly* recommended reads:
  - https://journal.thriveglobal.com/how-technology-hijacks-peoples-minds-from-a-magician-and-google-s-design-ethicist-56d62ef5edf3
  - https://www.theguardian.com/technology/2017/oct/05/smartphone-addiction-silicon-valley-dystopia



US Time Spent By App Category

Source: Flurry Analytics, comScore, Facebook, NetMarketShare. Note: US, Dec 2016



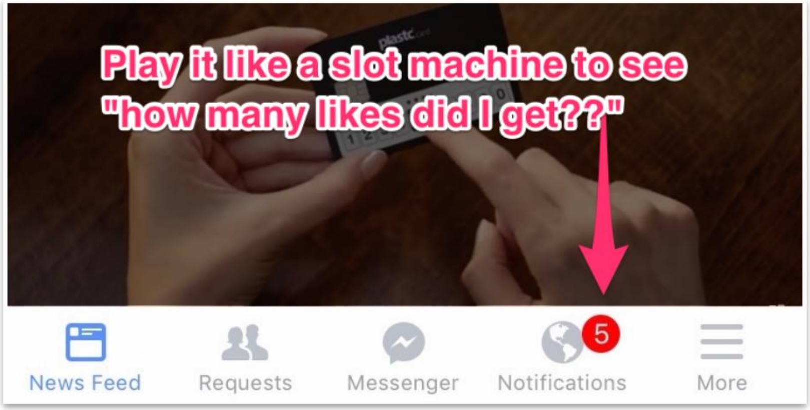
Percent of Users by Number of New Apps Installed*
May 2017

Source: AppAnnie

The great Slot Machine.

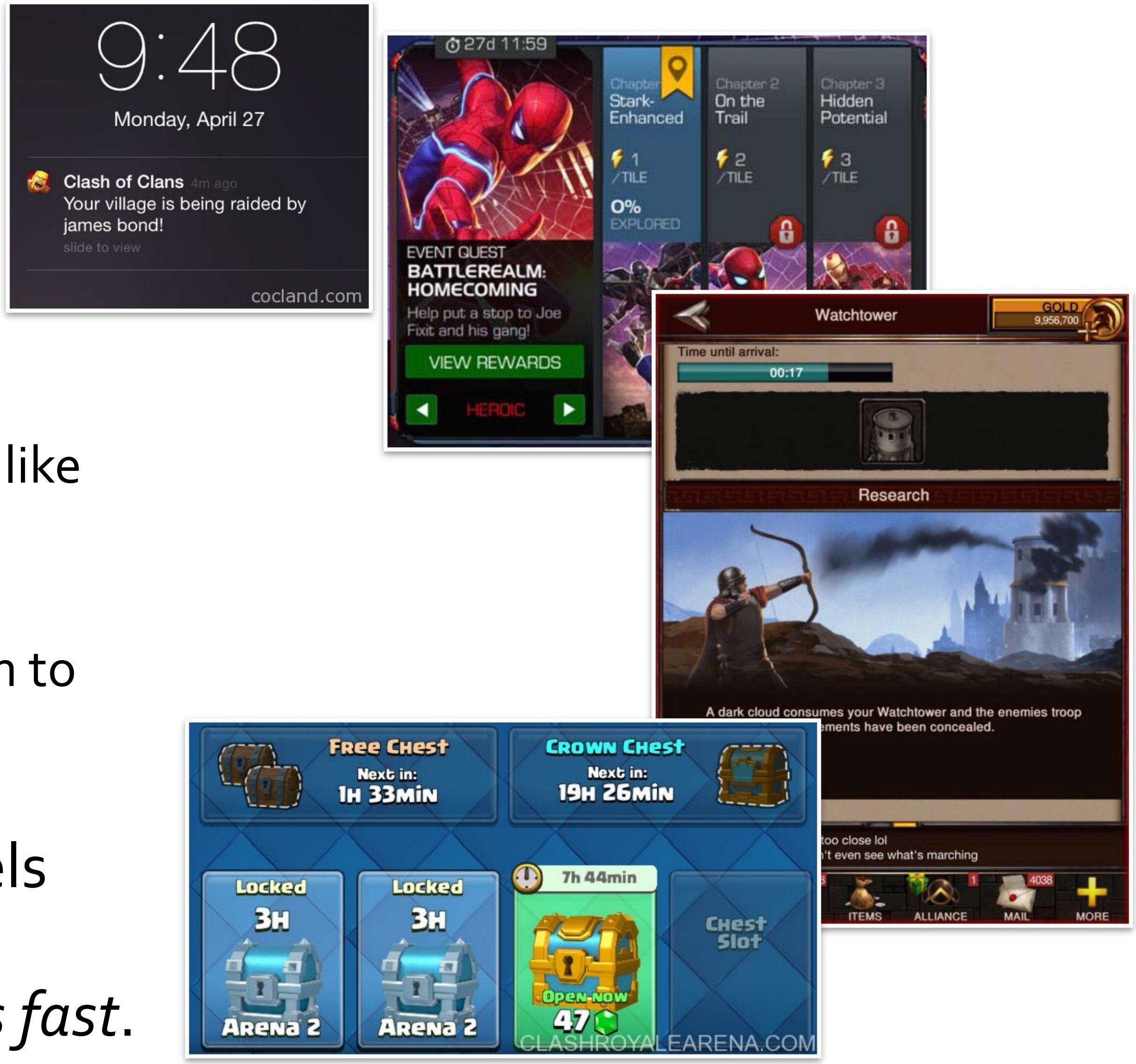
Intermittent rewards + Loss Aversion bias are some of the keys behind the stickiness of Social Media.

- **Intermittent rewards**:
  - An e-mail with some interesting question;
  - A post with some new friend’s photo;
  - A tweet with a new article.
- **Loss Aversion**:
  - “I don’t want to miss a new post from my family.”
  - “I don’t want to miss a message in my chat group.”
  - Snapchat’s Snapstreaks: " *‘If you lose the streak you lose the friendship,’ Peter Santa Ana, an 18-year-old in Honolulu, joked.”*


Play it like a slot machine to see
"how many likes did I get??"
News Feed
Requests
Messenger
5
Notifications
More

#: Appointment-based + Intermittent rewards

- Some possibilities:
  - Energy;
  - Delayed rewards (opening Chests);
  - Time-limited access to game modes;
  - Random gifts;
  - Random events;
  - Social systems interacting with the player like Social Media messages.
- Idle Games:
  - Core gameplay is about coming back often to optimize production
  - Heavy appeal towards Loss Aversion.
- Every 2 hours, have something that feels meaningful if the player comes back.
- Will be more effective *if the game loads fast*.



9:48

Monday, April 27

Clash of Clans 4m ago
Your village is being raided by james bond!
slide to view

cocland.com

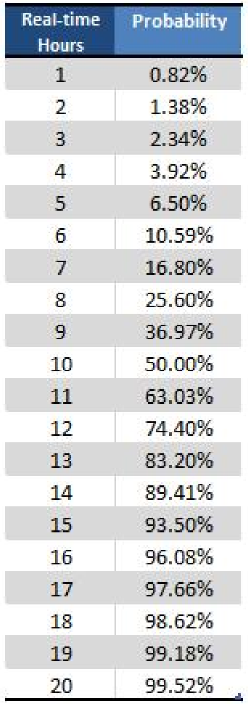
EVENT QUEST
BATTLEREALM: HOMECOMING
Help put a stop to Joe Fixit and his gang!

A dark cloud consumes your Watchtower and the enemies troop [illegible]ements have been concealed.

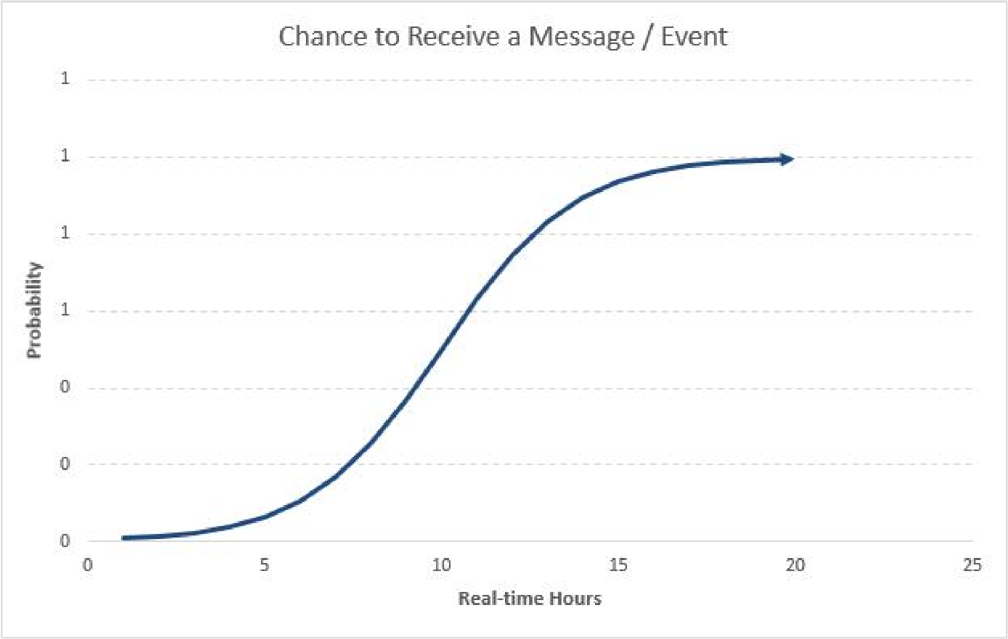
#: Idle time probabilities with Sigmoid

- Idea on how to sparse communication in the device dashboard to be intermittent but with a maximum interval guaranteed.

- You can also use it for intermittent in-game events, such as “special bosses” or “nemesis attacks” or multiplayer interaction like in Watch Dogs 2.



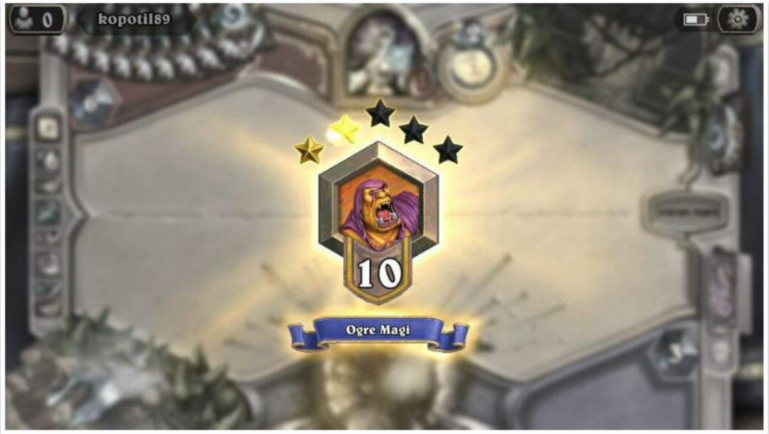
Real-time Hours	Probability
1	0.82%
2	1.38%
3	2.34%
4	3.92%
5	6.50%
6	10.59%
7	16.80%
8	25.60%
9	36.97%
10	50.00%
11	63.03%
12	74.40%
13	83.20%
14	89.41%
15	93.50%
16	96.08%
17	97.66%
18	98.62%
19	99.18%
20	99.52%



#: Loss Aversion bias

- Key to understand *a lot* of human behavior.
- People are usually *more* concerned about ***not losing*** what they have than about ***winning*** something new.
  - Free-to-play designs should work to counter *the feeling of loss*.
  - Loss is, of course, necessary sometimes in the loop. But then other designs need to kick in.
- People *are* willing to lose ***time***, but *not* to lose resources.
  - Balance with this mindset.

(Also results in the Sunk-Cost Fallacy: The tendency to continue to invest in projects just because and for the only reason they already invested a lot.)

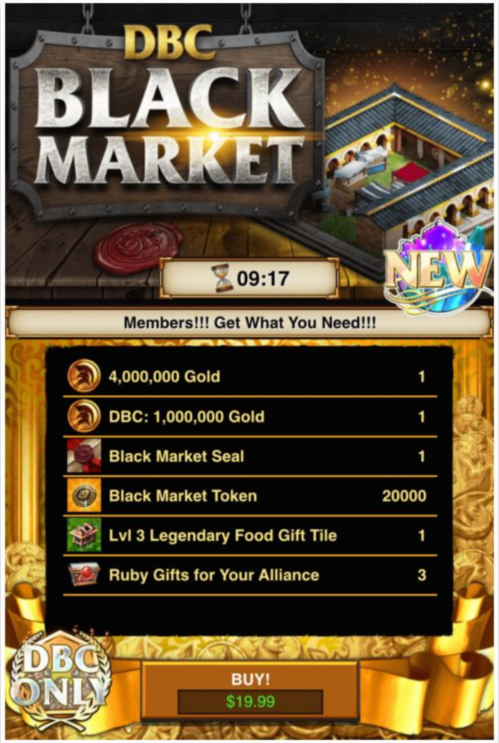


Bad design: crushing feeling at every loss in the main game mode, because the main game mode is a Ladder competition where Ladder resources (stars, rank) are taken away.

Common to hear about “Ladder anxiety” and people *avoiding* playing the game in the foruns and the community.

#: Anchoring / Framing

- People tend to **make decisions based on what they *see right now***, not on all the information they know.
  - Humans never use all the information available to make decisions – using lots of information is costly in energy to the brain. Instead, they replace it with *heuristics*.
- Anchoring is such a thing: decisions are made based on the information neighboring the decision hub.
  - So you can create artificial comparisons to "anchor" the decision towards what you want.
  - Very useful for IAP packs and IAP shop design.
- Also, you can use it to make *choice design* across the game systems.



DBC BLACK MARKET

09:17

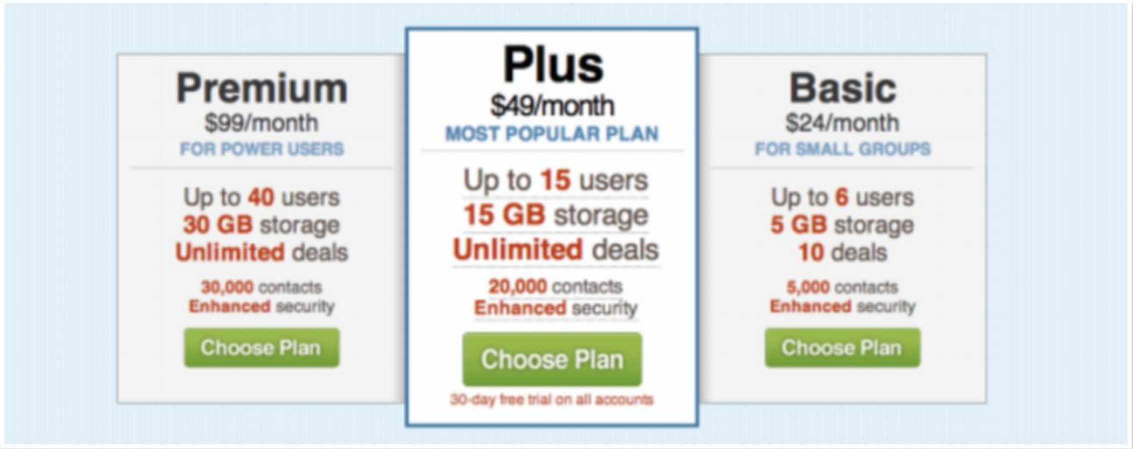
NEW

Members!!! Get What You Need!!!

4,000,000 Gold	1
DBC: 1,000,000 Gold	1
Black Market Seal	1
Black Market Token	20000
Lvl 3 Legendary Food Gift Tile	1
Ruby Gifts for Your Alliance	3

DBC ONLY

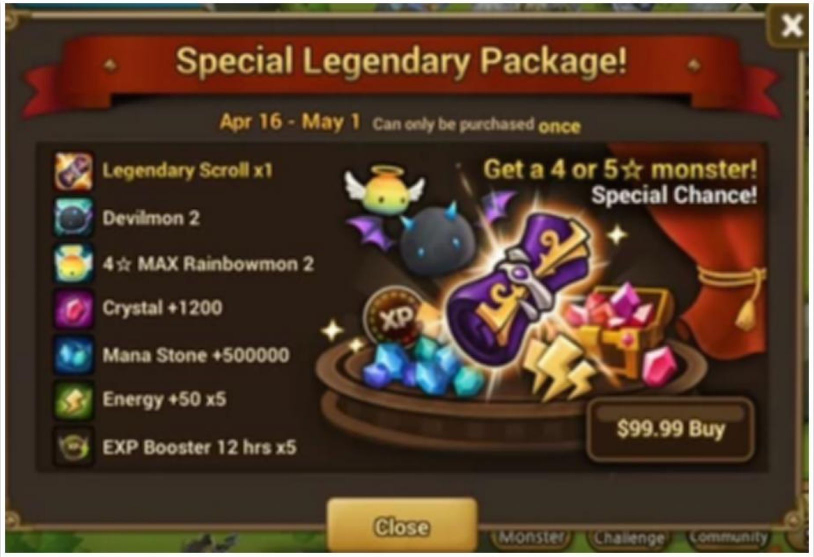
BUY!
$19.99



Premium	Plus	Basic
$99/month	$49/month	$24/month
FOR POWER USERS	MOST POPULAR PLAN	FOR SMALL GROUPS
Up to 40 users	Up to 15 users	Up to 6 users
30 GB storage	15 GB storage	5 GB storage
Unlimited deals	Unlimited deals	10 deals
30,000 contacts	20,000 contacts	5,000 contacts
Enhanced security	Enhanced security	Enhanced security
Choose Plan	Choose Plan	Choose Plan
	30-day free trial on all accounts	

#: Zero-risk bias

- Sell "guarantees".
  - Extra items, extra scrolls,
  - Guarantee Rare or more spins in your lottery.
  - Guarantee loot in your Events.
- Advertise it abundantly!
- People will pay much more to go from 98% certain to 100% certain.
  - Sometimes more than double.
  - And this is how Insurance companies make money. This + Expected Value calculations.
  - So now you can do your own Insurance company after learning game economy design! ☺

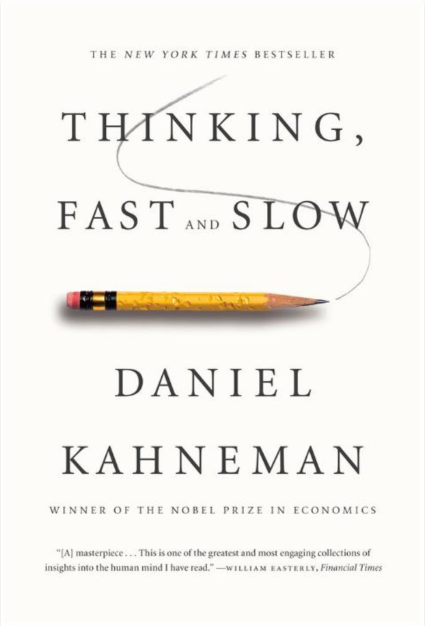


Special Legendary Package!

Apr 16 - May 1 Can only be purchased once

- Legendary Scroll x1
- Devilmon 2
- 4☆ MAX Rainbowmon 2
- Crystal +1200
- Mana Stone +500000
- Energy +50 x5
- EXP Booster 12 hrs x5

Get a 4 or 5☆ monster!
Special Chance!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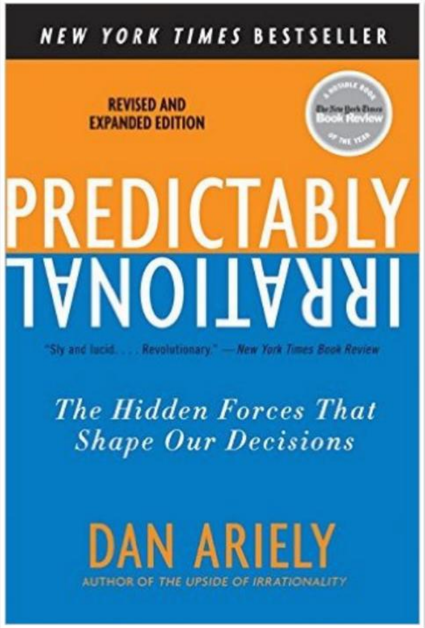
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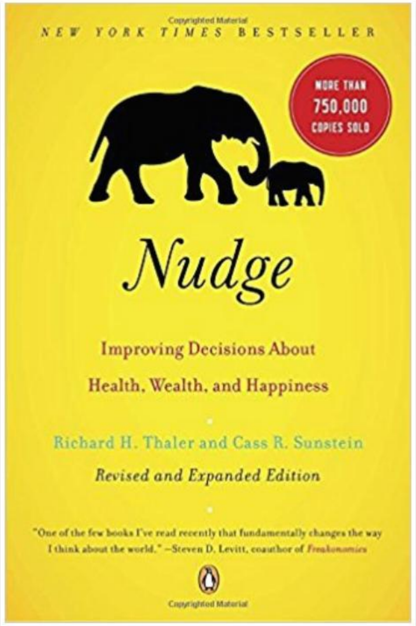
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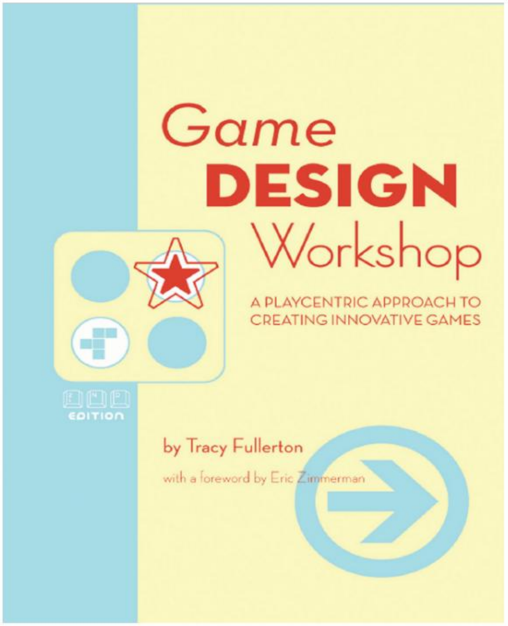
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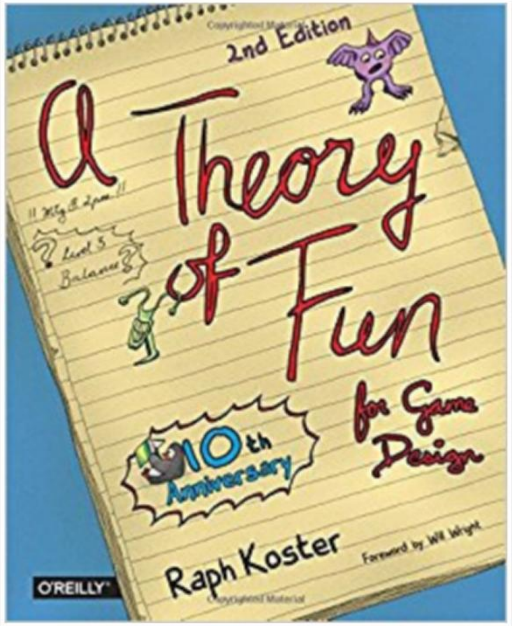
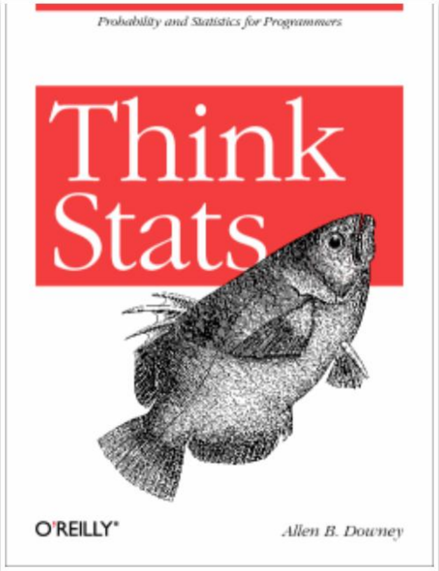
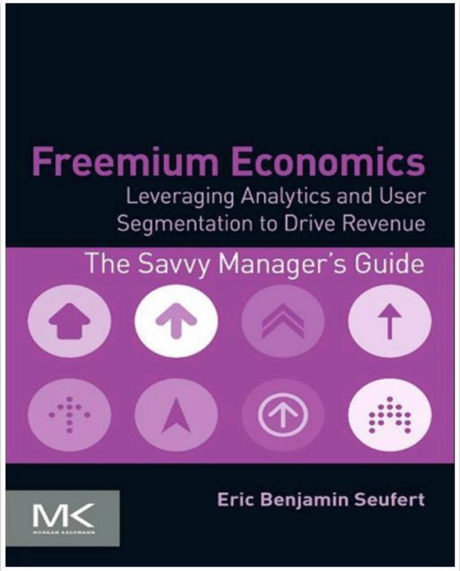
by Tracy Fullerton
with a foreword by Eric Zimmerman



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Eric Benjamin Seufert
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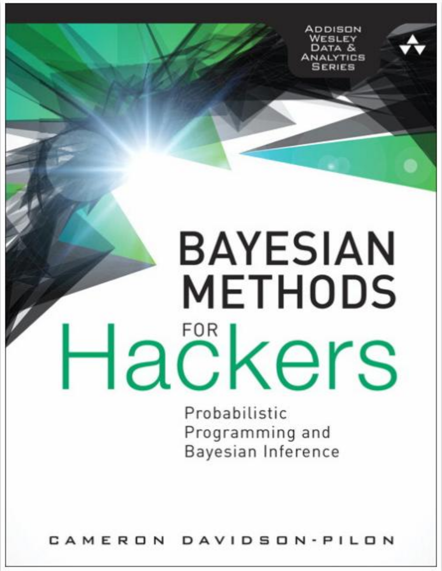
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Thank you!

Questions?

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