

# Game Design Principles 2

World/Level Design, RNG, Balance

# World/Level Design - Procedural Generation

what is procedural Generation?

# Procedural Generation

Procedural Generation is when a game is created quasi randomly by a system, rather than hand crafted by humans.



(Perhaps) the most famous procedurally generated game?



(Perhaps) the most famous procedurally generated game?

- Minecraft use seeds that they can break down into parameters for different generation functions.

# When is it used?

- Environments
- Enemy Encounters
- Loot Drops
- Theoretically, anything can be done with a procedural design.

Anything Is Possible



# Why use it?

- It is (virtually) infinite! Games like Minecraft and Diablo 3 don't just have tonnes of content - they have (virtually) infinite content.
- (virtually) Infinite user Experiences, meaning (virtually) infinite re-usability.



# C'mon, What's the catch?

- Well Johnny I'm glad you asked!
- It is expensive!
- It is difficult!
- And it has downsides with regards to the quality of a game you can produce.
- Also, it isn't infinite!

# Downsides?

Statement from Author of minecraft “Notch”:

“First of all, let me clarify some things about the “infinite” maps: They’re not infinite, but there’s no hard limit either. It’ll just get buggier and buggier the further out you are. Terrain is generated, saved and loaded, and (kind of) rendered in chunks of  $16 \times 16 \times 128$  blocks. These chunks have an offset value that is a 32 bit integer roughly in the range negative two billion to positive two billion. If you go outside that range (about 25% of the distance from where you are now to the sun), loading and saving chunks will start overwriting old chunks. At a 16/th of that distance, things that use integers for block positions, such as using items and pathfinding, will start overflowing and acting weird. Those are the two “hard” limits.

Most other things, like the terrain generation seeds and entity locations use 64 bit doubles for locations, and they do much subtler things. For example, at extreme distances, the player may move slower than near the center of the world, due to rounding errors (the position has a huge mantissa, the movement delta has a tiny, so it gets cut off faster). The terrain generator can also start generating weird structures, such as huge blocks of solid material, but I haven’t seen this lately nor examined exactly what behavior causes it to happen. One major problem at long distances is that the physics starts bugging out, so the player can randomly fall into ground blocks or get stuck while walking along a wall.

Many of these problems can be solved by changing the math into a local model centered around the player so the numbers all have vaguely the same magnitude. For rendering, Minecraft already uses local coordinates within the block and offset the block position relative to the player to give the impression of the player moving. This is mostly due to OpenGL using 32 bit floats for positions, but also because the rounding errors are extremely visible when displayed on a screen.

We’re probably not going to fix these bugs until it becomes common for players to experience them while playing legitimately. My gut feeling is that nobody ever has so far, and nobody will. Walking that far will take a very long time. Besides, the bugs add mystery and charisma to the Far Lands.”

# Downsides?

- What if you spawn a player in a room with no doors?
- What if you make levels unbeatable?
- Loot that is too strong/week/can't be obtained?



# Negative possibility space

- This is the effect a designer/developer leaves behind as a result of not filling an expectation.
- An expectation that is usually involved in areas of a game you had not intended on being actual content.





# What do you do with it?

- You must always acknowledge a negative possibility space!
- Use chests with meaningless rewards, or some kind of message. Anything!





You werent  
supposed  
to be able  
to get here  
you know

04:23

5000000000

1000000000





# This applies to Narrative too

- In the same sense of hard to reach spaces being an expectation, so too are decisions in conversation.
- If we recall the choices we should be forcing players to make down the line in their progression system, these are similar sort of cues we want to give in chats.

2 Clementine will remember that.



RNG



# Randomness does 3 things:

- It creates exciting moments
- It occasionally lets the weaker player win
- It forces strategy to be changed

# Designing for RNG based content

- We can look at card games for this, but it can be applied to anything.
- Also, keep in mind the topic of power creep when you think about RNGs. They are closely related!
- The Delta of randomness (the difference between power when the best case vs worst case happens) should always be small.
- But this does not mean that it should have little effect. The effect can be large, but ideally, it should not be a make-or-break type of chance.
- It will not be exciting for both players if one of them has 2x more damage than the other . . . that is just a chance based win. Nobody really likes that.

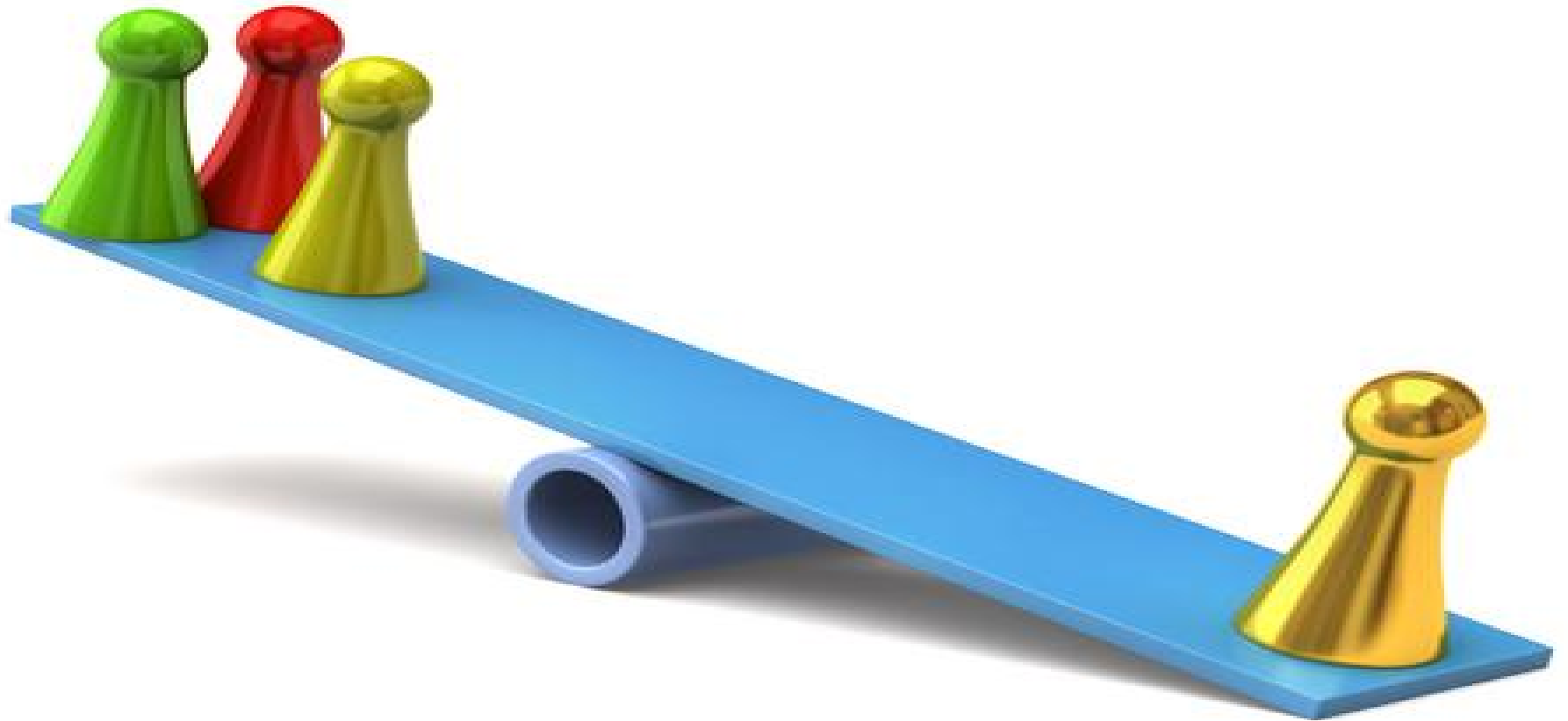


via Wowhead

# Balance should be considered!

- Ideally, an RNG's positive effect should open up an avenue of advantage, which requires your player to change his strategy to accommodate the advantage or disadvantage. It should not be so game-breaking as to end the game!

# Perfect Imbalance





# Why is balance not always the right answer?

- Balance and content fight each other.
- If you want to generate more content, then there will be imbalances.
- Likewise, if you want balance, you need to at least put constraints on content so that it remains similarly balanced.
- Consider Chess. It is balanced, and both players have literally identical pieces/abilities/strategies, and nobody really plays it (I'm aware thousands/millions do, but many many more play video games with more variety!)

# Consider some League of Legends

- A champion is always meta (not always the same).
- This forces a community-wide theory crafting forum to try to counter a particular choice.
- It forces better thinking!
- It also goes terribly at times . . . .



Chart Type Highest Win Rate Champions ▾

Region All Regions ▾

Map ☒ Summoner's Rift ☐ Twisted Treeline ☐ Howling Abyss ☐ Crystal Scar

Time ☐ Daily ☐ Weekly ☒ Monthly

Queue ☐ Normal ☐ Ranked Solo ☒ Ranked 5x5

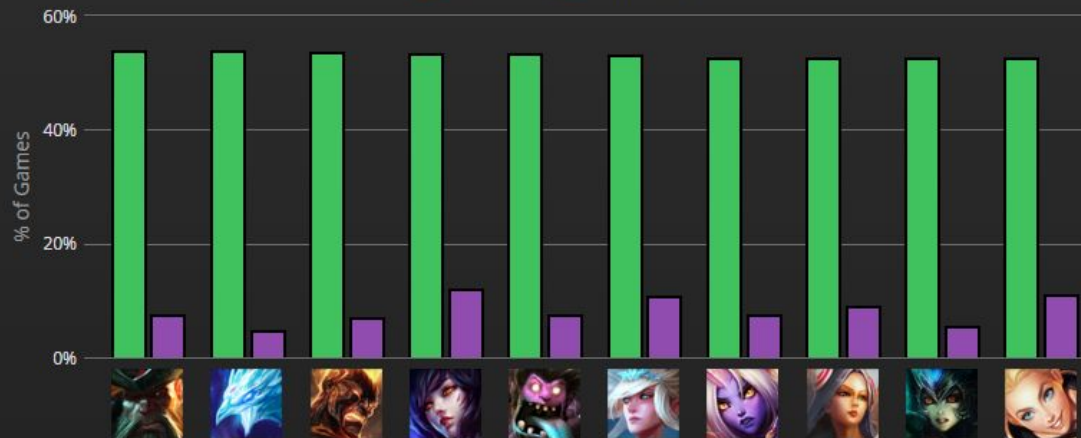
League ☒ All Ranked ☐ Bronze ☐ Silver ☐ Gold ☐ Platinum ☐ Diamond ☐ Master+

### Highest Win Rate Champions (10/25/2015 – 11/24/2015)

LOLKING.NET

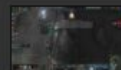
#### Highest Win-Rate Champions

Win-Rate Popularity



Top Streams

All Streams



**Nightblue3**

👁 26689 🏆 2570



**Motroco**

👁 645 🏆 2480



**Electrokidi**

👁 315 🏆 2316



**Simple Nickname**

👁 123 🏆 2204



**Agula**

👁 112 🏆 2200



**KaZiggs**

👁 101 🏆 2270

foodplanet

# Let's play around a little

<http://www.lolking.net/charts>