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Designing a Boss Arena for Encounters Requiring Geometry

The Challenge

This development log covers the trials and tribulations of designing an encounter for a first person, four player, cooperative boss fight and all the lessons learned. During development, this game faced the unique challenge of having **a colossal enemy with a player controller that required overhead geometry to function**. So if you, too, find yourself in the unenviable position of a **level designer or encounter designer**, designing for an action boss that requires movement and an unconventional player controller with tight geometry, then this log is for you!

Common Arena Tropes

Famously, **boss arenas are typically large empty rooms** smacked as an exclamation point at the end of a level. I think we've all encountered that moment where you walk into a space and you immediately stop and say, "oh, this is definitely a boss arena." Mark your saves and check your gear, we all know it's coming. After researching over 30+ games, ranging from Borderlands to Dark Souls, this trope held strong.

(Dark Souls III and DOOM: 2016 arena's)

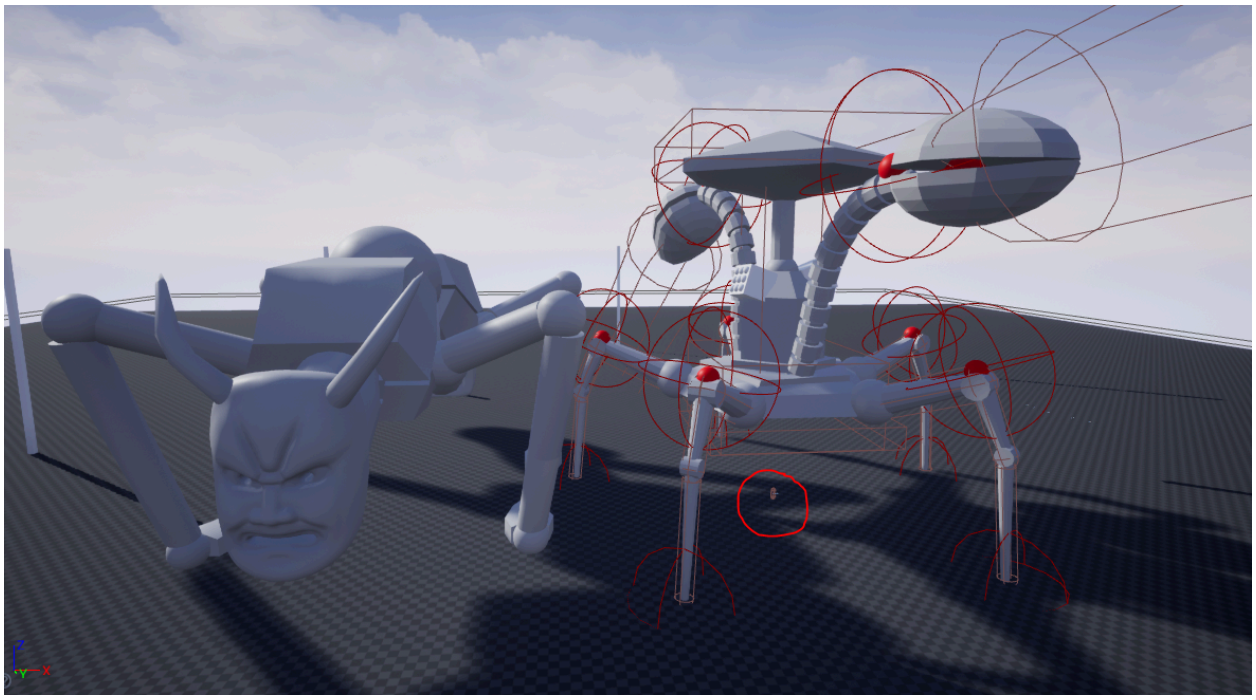
Now, there are several reasons for this but some of the main ones are:

- AI mobility and execution
- Player mobility
- Sightlines
- Encounter focus

AI requires space**,** and lots of it. Many action bosses move swiftly and execute a large variety of attacks. As such, level designers usually open up large spaces to accommodate the AI, and to **reduce the chance of game breaking bugs**.

Additionally, in high mobility games such as DOOM, the open space of **an empty arena benefits the player** by allowing them plenty of room to dodge and punish the boss. This type of action economy with environment space is a cornerstone of most boss development.

Now, let's say you have designed a player controller that requires a great deal of closely spaced geometry to function. We'll take the route of grapple based character mobility, such as those seen in Spiderman or Attack on Titan, and we'll meld it with a boss like those found in Dark Souls or DOOM, but scaled up to the size of Shadow of the Colossus. This exact premise was the main mechanics of my own game False Gods, and we will use it as a case study for this log. We now have arrived at a critical design problem. **How do we give the boss the space it needs, while giving the player the surfaces they require?**

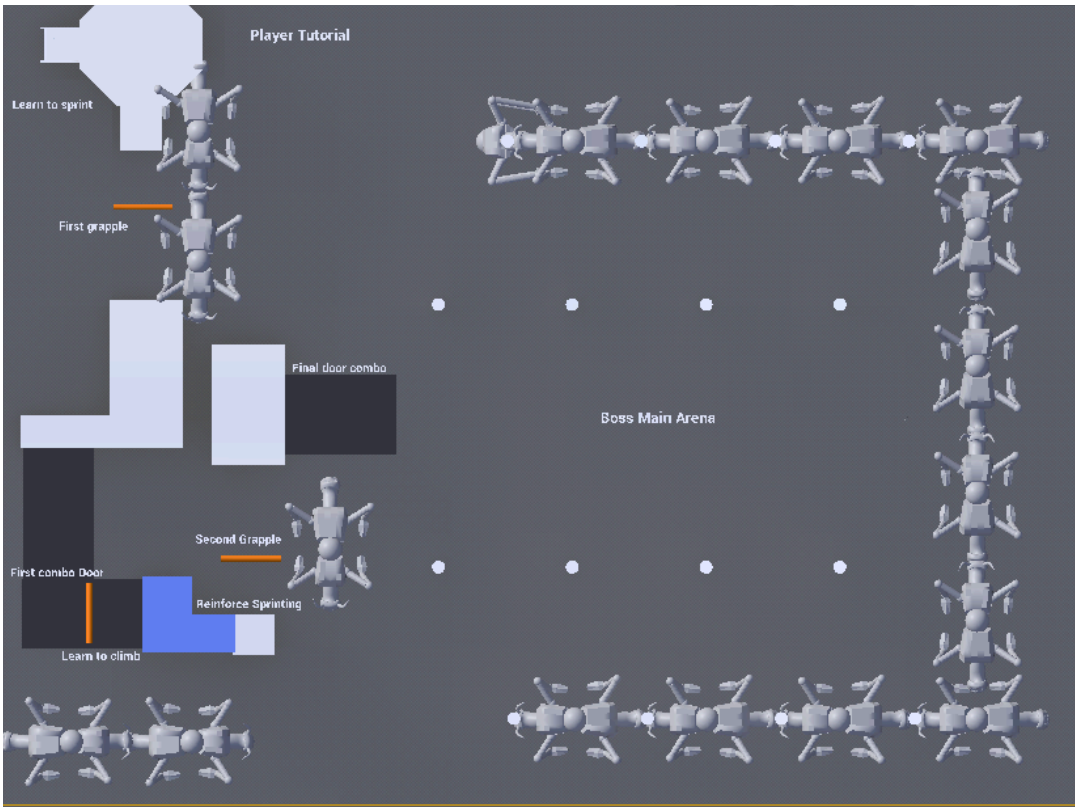


(Boss designs for False Gods. The circled object is the size of the player in comparison to the bosses)

When You Need Geometry - Determining your Metrics for Engagement

To begin, there are a few **critical steps** that should be taken before moving forward with any sort of level or encounter design as each game and boss is different.

- Metric the boss size, attacks, and movement
- Metric the player movement and attacks
- Test the player and boss metrics against one another



(*Metrics testing arena constructed for False Gods.)*

The most important aspect for your metrics is to determine a standard ruler. Ideally, the development of the boss and player controller should be done together, but with iteration comes differentiation. Keep consistency as the game changes! To ensure this, constantly test the player metric against the boss metrics. As seen in the image above, one method is to use the boss itself as the ruler.

	Run	Sprint	Grapple
Boss Length (Time in Seconds)	7	3	5(run) 2(sprint)
Grapple Distance (In Boss Lengths)	1. 5	2	-
Arena Length/Width (Time in Seconds)	35	15	7
Height (In Boss Lengths)	1.5	-	1.5

Grapple hook distance 75m

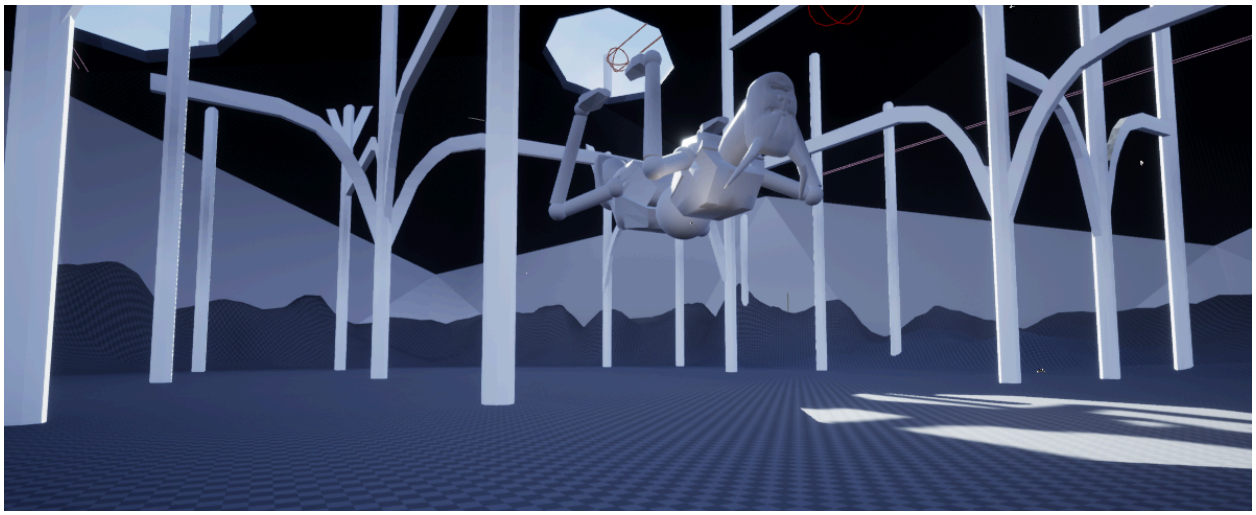
(Player to boss metric chart)

By testing the boss and player metrics against each other, and keeping a living document of your metric changes, **you are keeping a set of quantitative data that will inform your designs moving forward.**

Level Design - Boss First Versus Players First

Now that you have your boss and player metrics, it is time to design your arena! There are a few different methods to determine the focus of your design. For the purpose of this log we will cover three methods:

- Boss First Design
- Player First Design
- Designing for the Boss and the Player Simultaneously



(Early greybox for False Gods)

Boss First Design

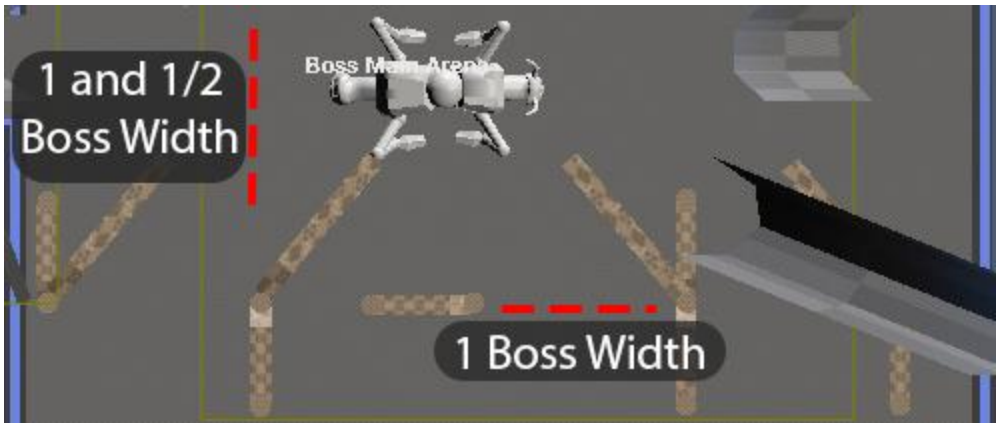
(Boss Design of False Gods)

Boss first design simply means accommodating the metrics of the boss as a first priority. It does not mean throwing away player centric design, or ignoring player metric design.

Returning to the idea of the grapple based character controller against a colossal boss, an example of boss first arena design is setting **minimum viable spacing to the maximum allotted metrics of the boss.** In practical application the following steps would be used to determine the viable spacial parameters for the AI:

- Boss length, width, height
- Turn radius
- Boss movement average with an acceptable padded radius

This means that the maximum width for object spacing is reliant on the greatest denominator of the bosses metrics, accounting for AI navigation variability.



(Arena Design Using Boss First Metrics)

Pros Boss First Design

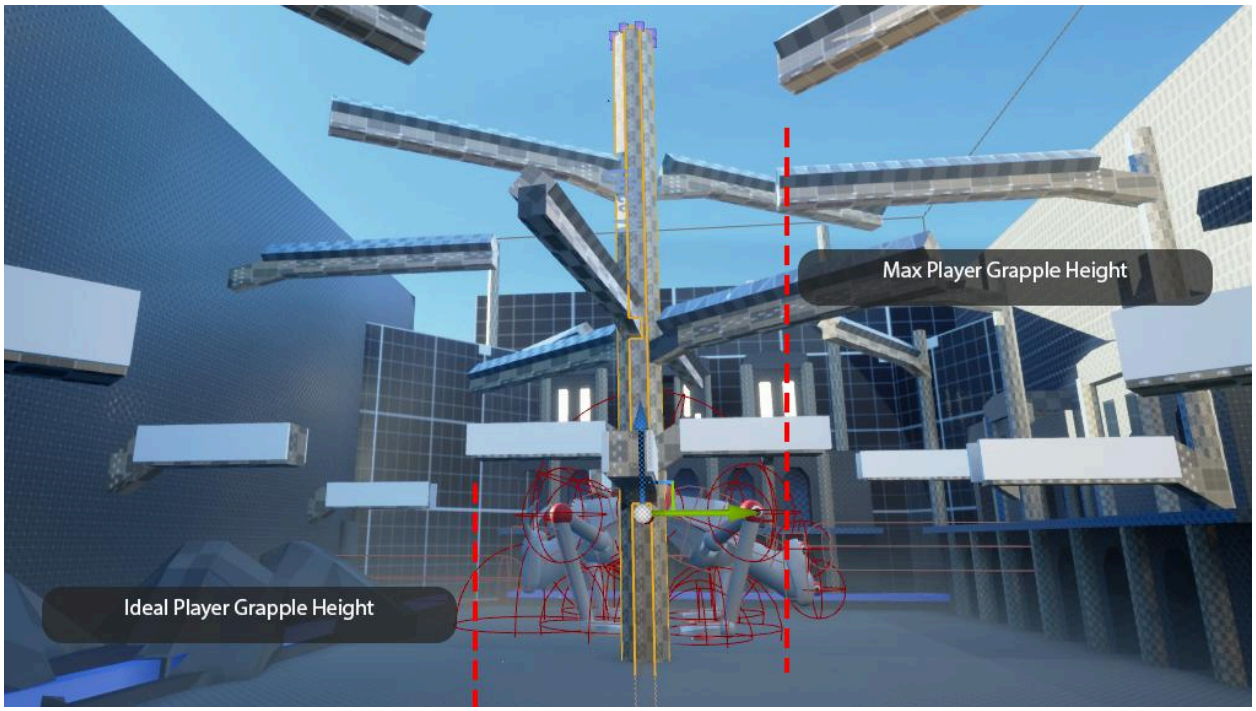
- Reduces chances of clipping
- Reduces chances of jitter
- Reduces chances of collision related bugs
- **Ensures AI has room to execute**

Cons Boss First Design

- Does not account for player preferred metrics

Player First Design

Player first design accounts for the metrics of the player over the metrics of the boss. Essentially, instead of using the bosses greatest metric denominators to determine the minimum viable spacing, **the players average metric is used as the standard ruler.**



(Arena Design Using Player First Metrics)

In the case of the False Gods, that means that the arena metrics are determined by the grapple distance and speed. As shown in the image above, the geometric spacing of player utilized geometry is set to the ideal width and height of the player mechanics. The result is low clearance for the boss, but the best possible spread of usable geometry for the player.

Pros of Player First Design

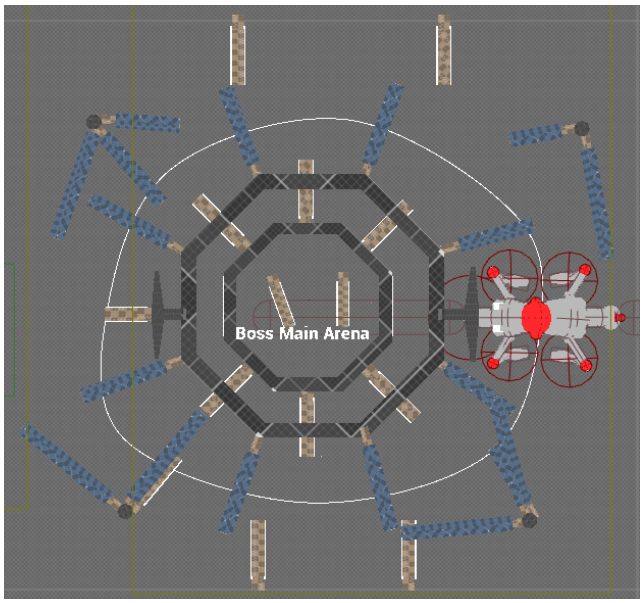
- The arena space is best suited to the mechanics of the player
- Usually results in the **best space to accommodate player feel**

Cons of Player First Design

- Does not account for boss maximum metrics
- Increases the chances of collision related bugs
- Increases the chance of clipping and jitter
- Increases chances of failed AI spacial execution

Designing for Both Player and Boss Simultaneously

There are many ways to design to account for both the boss and the player. The simplest way to achieve balance is to use the **maximum viable player metric against the averaged required boss metric**. It is important not to use the minimum viable boss metric. The result is accommodation for the player at its highest range and the boss at an acceptable average.



(*False Gods arena design accommodating boss and player metrics)*

Another method is to take the averaged boss and player metrics and select geometry at the widest spacing of the boss minimum metric. In essence, this style of accommodation places geometry at the preferred player height at the distances required for the boss to navigate through. The same could be done vertically if the mechanic in use is oriented as such.

By accounting and finding a balance between the player and the boss you are neither catering to, or ignoring either aspect of the game.

Pros Accommodating for Both

- Both the boss and player mechanics are taken into consideration

Cons Accommodating for Both

- Neither the boss nor player mechanics are the focus, thus both lack the geometry to reach their full usage
- By using the average metric for the boss, there is a reduced chance of bugs over the minimum viable metric in the player first design
- However, not using the maximum viable boss metric means there is a higher chance of failed AI pathfinding execution

In the case of False Gods, my team eventually decided to design for both the boss and player at the same time. As a result, several different mechanical changes were required to ensure that the boss could still function with the lowest possible chance of bugs.

Encounter Design Tips and Tricks

Perhaps your player controller only feels good at a short distance, and the boss only threatening at its current size, and thus a perfect metric balance cannot be struck. Regardless of whichever of the options above you utilise, changes will have to be made to the design of the encounter itself.

Player First:

- "Fake" the boss AI pathing using splines or waypoints
- Remove control from executed AI for things such as charges or melee specific targeting and drive it directly
- Handle boss movement through transforms over physics or navmesh in order to prevent clipping
- Create destructible geometry for the boss to eliminate
    - A note about destructible geo; If the majority of your geometry is destructible, and the boss is highly aggressive, you may create a negative feedback loop.

Boss First:

- Change the player FOV on movement to make them feel as though they are moving faster or slower
- Highlight the geometry that is available and keep a strong shape language between usable surfaces
- Have the boss create temporary player geometry while it is stationary
- Use level transitions if the boss is changing aggression/size/movement over different phases

Finding the Balance

Regardless of which methodology you decide to use, or in the case of my own game all three in multiple variations, ensure you test your design and iterate!

Case Study Results - False Gods Final Execution

For False Gods we constructed the following:

- One three tiered arena with a set transition to a two tier arena
- The first arena was constructed using player and boss metrics averages
- The second was constructed with boss first design
- We utilized controlled movement and specific pathing to ensure the boss could execute navigation smoothly
- We added an attack that created and destroyed geometry in specific phases

(Final arena and tutorial)