

Jenga Fortress Final Report

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Unity Version: 2020.3.24f1

Game Description

Jenga Fortress is a 2 player AR game played on a single device. Each player's objective is to make the opponent's hidden core block leave its boundary in order to win. After setting up the game environment, placing their fortress and hidden core block at their desired locations, they take turns firing blocks at their opponent's fortresses. Players can also move individual blocks from their own fortresses to protect their block, or fling it at the opponent - which doesn't seem to work as well as we thought.

Requirement	How It Is Met
Unity assets	Fortress built out of "wooden" blocks. While each individual block can be considered an asset, we consider the fortress to be our asset as it contains both the "core block", which along with the boundary defines our winning condition, and the interaction between blocks.
Player interaction	Players can spawn their fortresses, fire blocks which explode on impact, and move existing blocks. Furthermore, debug controls allow players to enable or disable gravity.
Anchors	The ground plane is instantiated at where the player places the reticle, and is then anchored to the nearest detected plane. The anchor is attached to the ground plane.
Image Tracking	Although image tracking is implemented, we have decided to not use it at all in the final version. This is because we have found it to be slower to setup the ground plane compared to simply placing a reticle on the detected planes.

Ray Casting

Raycasting is extensively used in our game. It is used to place the ground plane, designate the location to place fortresses and core blocks, and finally move existing blocks around. AR ray casting is used to place the ground plane reticle first to place the ground plane.

Additional Techniques from the Module

We have attempted to implement Light estimation, but it does not seem to work for us at all - Unity seems to be unable to find our phones' light and color temperature data. While we have point clouds, it is not used in the game. Image tracking is implemented but not used.

Additional Techniques from outside the Module

Scaling techniques were used to maintain physics stability while making the blocks small enough to be playable in an AR environment. This specifically utilizes AR Foundation's "MakeContentAppearAt()" method, increasing the size of the ARSessionOrigin rather than reducing the asset scale.

Maintaining acceptable performance on the phone with the amount of rigid bodies was also a large issue, mitigated by reducing the simulation accuracy of Unity's physics engine. Modified variables includes fields such as

- Bounce Threshold
- Default Max Depenetration Velocity
- Sleep Threshold

Occlusion on Android phones is implemented, which only works on phones which support Depth API. This greatly improves immersion of the AR experience. Although not present in the video, the code exists on our github.