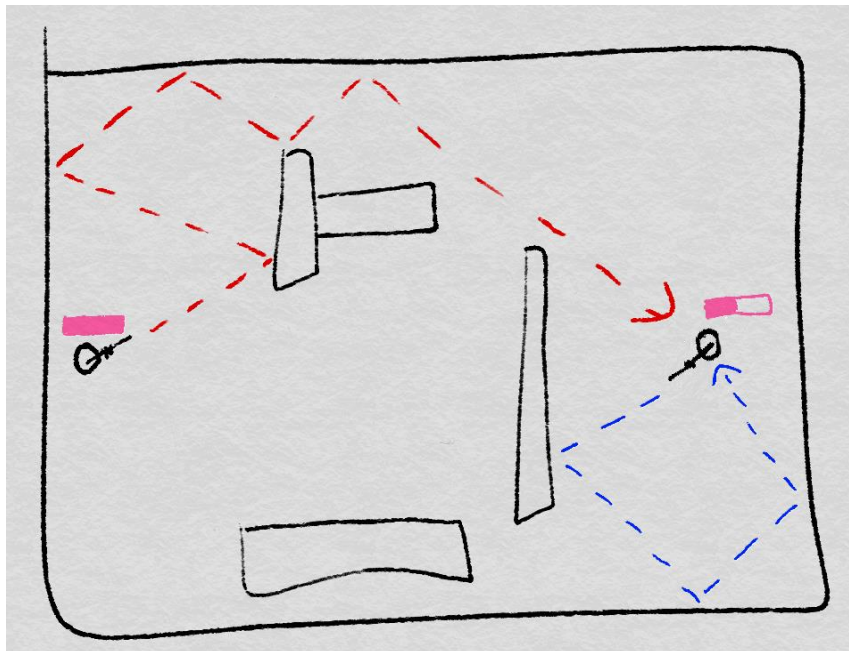


# Game Proposal

## 1. Game Description

The game “Lumen Force: Sneller Than Light” (subject to change) will be a top-down shooter focused on arena levels. It implements the course theme “Arcade” via the core aspects of representative arcade games. These elements are the fast-paced action combined in an arena shooter with a top-down perspective supporting local player-versus-player (PvP) skirmishes.

Our game focuses in this course on the PvP fights with the goal of being the last player being alive, standing in the arena. For this we need to fulfill a promising situation for players to have fun and showing skills at the same time. The game will take place in a Sci-Fi setting. Thus, the players will be equipped with futuristic weapons, shooting light projectiles with different radiant power and other light properties. This leads to different amount of damage being dealt on a hit player by one of the various projectiles. To increase the game depth each projectile can be reflected by every object in the scene. Therefore a covered player behind two objects can still be hit by a well targeted projectile on the neighboring walls to bounce off and reflect towards the enemy player. But our projectiles have a bigger effect. They will not only be reflected, they also follow the rules of light properties, meaning reflected projectiles will lose in power, as part of it will be absorbed in the object. Depending on the object’s material, it will also spawn additional weaker projectiles for complete diffuse surfaces or even spawn transmitted projectiles on the other side of an object, following the refraction rules by Snell’s Law. Further information on the light physics will be listed under Technical Achievement.

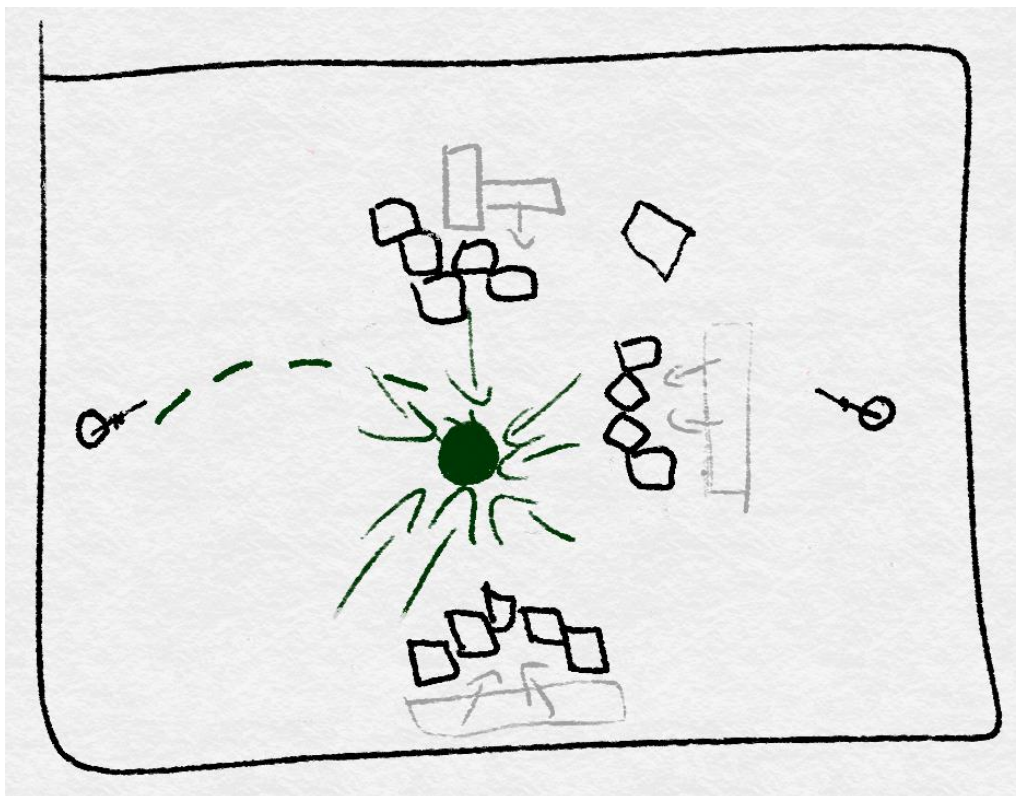


Reflecting Projectiles, players can hit themselves (Friendly fire).

Additionally, the energy being absorbed by these objects in the scene or through many transmitted projectiles, the objects can be destroyed. This will break the object into smaller ones, which can hurt the player standing close to the moving fragment, though it also leads to cover on other positions. If the objects get too small, they will vanish as dust. See for more information on destruction the Technical Achievement.

Because of the number of projectiles in flight can reach a great amount, players won't get defeated by one hit. They will have a health bar, which will decrement depending on the energy level of the projectile hitting the player. For future updates on the game there might be some health regeneration by Power Ups, but these won't be implemented for the first versions.

Also different weapons as an explosion grenade, pushing objects away, or vacuum grenade, pulling objects into the center of the grenade, will be targeted for the final game.



Vacuum grenades pull loose objects into the direction of implosion.

Our game will be a 3D game with a top-down perspective, effectively being a 2.5D game. The models will be some simple assets with basic animations for the necessary actions.

For our controls we decided to use the Twin-Stick controls.

The left stick of one controller will change the player position on the arena map.

The right stick represents the orientation of the player. That way a player can retreat while shooting in the opposite direction. This seemed to be the best solution for a fast-paced action shooter game without making the controls too complex.

The right trigger will shoot light projectiles until the player has to reload or the weapon will cool off from weapon overheating. This still has to be decided until a playable version can be tested, as these will change the feeling of the game depending on the strategic influence of either one.

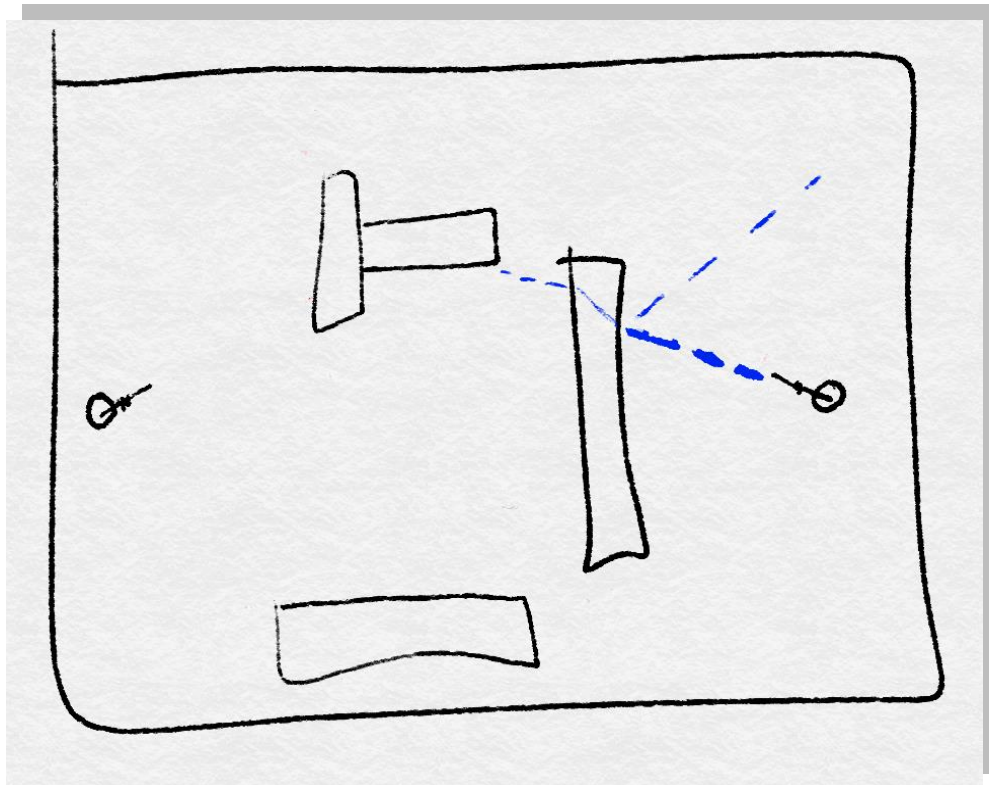
The left trigger will throw grenades, which can bounce off of walls and objects, too.

The arena map itself will be composed of simple textures, as they should not distract the player from the action and the many projectiles in flight. Objects like deserted buildings or statues will be randomly placed in the arena, so each fight will be played differently.

For further versions of the game, there might be different gaming modes like Capture the Flag or a Co-Op wave scenario, where AI controlled enemies try to take down the player's base. The players then have to play together to hold out as long enough as possible. But they should be careful, as friendly projectiles can damage your teammates and yourself.

## 2. Technical Achievement

The game comprises two major technical achievements, the reflection of laser shots incorporating the properties of light and the destruction of objects resulting in smaller, separated sub-pieces.



Transmitting and reflecting projectiles.

Instead of having simple reflections of bullets, using the force and incoming direction for calculating the outgoing force and outgoing direction, the game uses laser weapons. Laser is "light amplification by stimulated emission of radiation"<sup>1</sup>, thus considering light properties seems to suggest itself.

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<sup>1</sup> [Gould, R. Gordon \(1959\). "The LASER, Light Amplification by Stimulated Emission of Radiation". In Franken, P.A. and Sands, R.H. \(Eds.\). The Ann Arbor Conference on Optical Pumping, the University of Michigan, 15 June through 18 June 1959. p. 128. \[OCLC 02460155\]\(#\)](#)

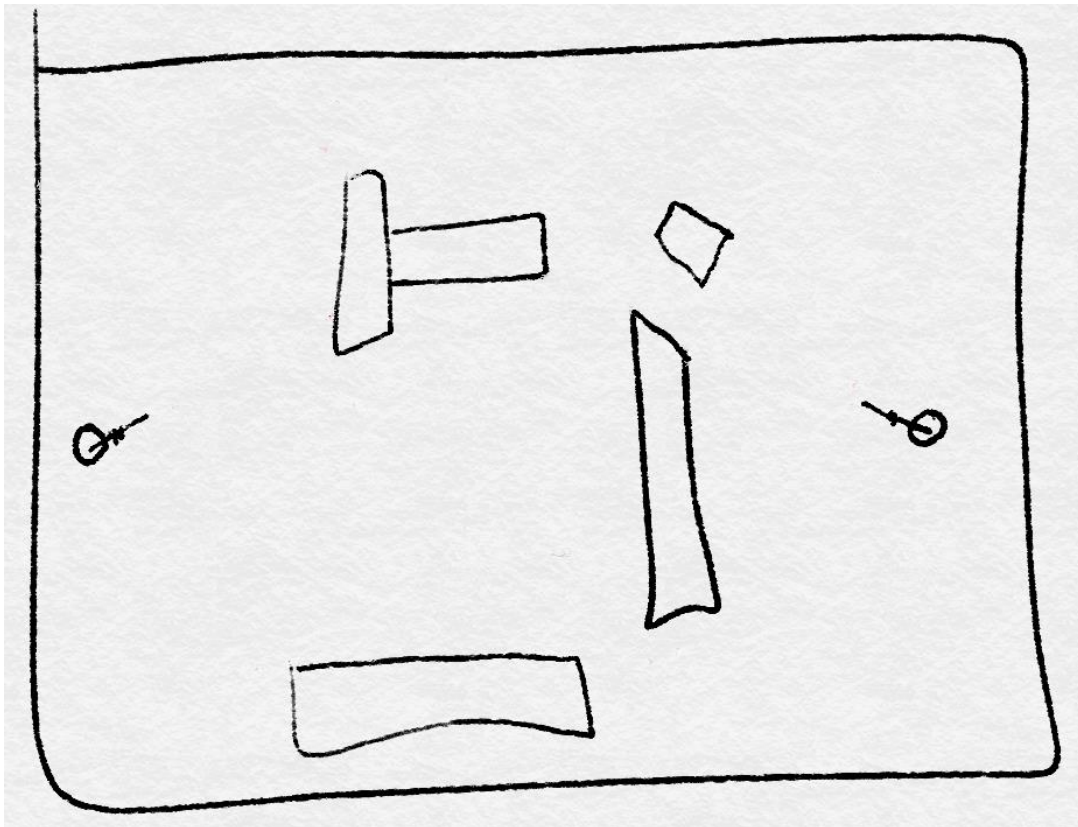
Once having this fact in mind, we can include the principles of transmission/scattering, absorption and reflection of light rays, whose radiance also indicates the amount of damage a player receives being hit.

The effect of scattering is realized by applying Snell's law, such that the refracted ray through the hit medium is computed, affecting only the voxels of the object which intersects the ray. We also can define it as a local effect within the object. In comparison, absorption acts globally on the whole object. Thus, a specific amount of energy, using the imaginary part of the refractive index of the hit medium, gets absorbed and distributed among all voxels equally within the object.

Reflections are composed of a specular part and a diffuse part. The specular reflection results in a laser ray of pretty high energy, depending on the absorption and transmission. If the amount of energy is higher than a certain threshold, a specular reflected laser ray can get reflected again by another object. However, diffuse reflections are vast in numbers but contain very low energy, which deals only little damage on the players and in case it hits another obstacle, it gets completely destroyed. This prevents an over-scaling of the amount of active rays travelling through the scene and interacting with the actors.

All effects on the laser projectile are scaled by the material properties and the initial values of the laser projectile itself. Thus, different laser shots and obstacles yield to various behaviors and results in the interaction with the scene.

As already indicated above, the obstacles in the arena are composed of voxels, which contain information about the position within the object and about the amount of received damage in a scale from 0 to 1, while 0 indicates no damage received and 1 indicates completely destroyed.



Obstacles can be destroyed in sub-pieces.

In this way, the destruction concept of the game is realized. Representing the objects with voxels, the extraction of subparts is computed by removing the respective voxels away from its original object and building up a new one.

Getting back to the transmission example from above, all intersecting voxels with the scattered ray are computed and for each the received damage information is updated. Once a voxel gets completely destroyed, which is the case if the received damage information holds a value  $> \varepsilon$ , while  $0 < \varepsilon \leq 1$ , and if a connecting line of “broken” voxels from one surface to another is detected, the object is cut. Since the line is restricted to lay on the xy-plane, because it is not possible to shoot up- or downwards, the orientation of the cutting plane is also restricted. Depending on the dimensions and orientation of the object, either the xy-, yz- or xz-plane is defined as cutting plane.

All cut voxels are deleted, causing forces pushing the two separated subparts of the object away from each other. This results in two smaller obstacles at different positions than the former, bigger object.

This concept might lead to very small obstacles, which have no real effect on the gameplay because of their size. To prevent this, a threshold is introduced and every obstacle smaller than a reference size is deleted, creating dust on their position to indicate a complete destroyed obstacle. Also, an obstacle which absorbs an amount of energy explodes completely without creating new, smaller sub-pieces, since all voxels received the same amount of damage.

Minor sub technical achievements are a random map generator and artificial intelligence for computer controlled enemies.

The random map generator shall fulfill certain constraints, such as not overloading the map with obstacles, creating corridors between them and in an even more advanced setting differentiate between different degrees of difficulty.

The field of AI can be explored in a wide manner, however the game will – if even included – focus on a very basic level of AI, such that the enemies do not get stuck at obstacles which refers to path finding and such that they shoot at the players.

### 3. "Big Idea" Bullseye



### 4. Development Schedule

See Attachment.

### 5. Assessment

With the proposed game being very action packed and fast paced, quick reactions and fast decision making are required to play the game. These properties and the Sci-Fi setting will appeal especially to a younger audience. The coolest feature is going to be the destructible game objects, which allows the player to manipulate every object in the scene.

Although it is an action filled arena shooter, the player has to think outside the box. While dodging other projectiles, he has to quickly come up with a strategy to hit his opponent using his own reflecting projectiles and taking advantage of destructible objects. Herein lies the main strength of the game. A weakness could be the lack of a game element which provides long-term motivation.

The smart combination of the action and strategy elements will shape the success of the game. The strategy component must not slow down the pace of game, but on the other hand it has to be relevant and contribute to gameplay.