# OCR Computer Science NEA

A group of people with text

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Bullet hell A-level project using pygame.

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# Analysis

## Describing the problem.

##### The goal

Using PyCharm Community Edition 2024, I will develop a ‘bullet hell’ game using the module pygame from python, as well as json (JavaScript Object Notation) to store metadata. A bullet hell is a subgenre of the popular arcade game genre of ‘shmup’ (or shoot ‘em up).

##### Explanation of shoot ‘em up

This style of games is commonly described as a 2D shooter where a spaceship or any other substitution for the player moves around the screen and dodges enemies shooting projectiles. The objective is to defeat the enemies on the screen using the players gun or any other form of projectile firing tool. The most famous arcade example of this genre being ‘Space Invaders’ featuring the iconic aliens:

##### Explanation of bullet hell

The bullet hell subgenre takes this to the next level by keeping the main objective of defeating enemies but shifting the objective by ramping up the number of bullets on the screen until the focus of the player is to dodge the bullets and survive and defeating enemies becomes a side goal. An example of a Japanese arcade bullet hell called ‘The Touhou Project’ (or just ‘Touhou’) can be seen below:

## Identifying the stakeholders.

##### Age and motivation

The target audience for my game are people anywhere up from 14 years old but will probably be most prevalent with college students who have enjoy playing video games for the personal improvement and sense of achievement it gives, although older video game enthusiasts who enjoy the modernized approach of the arcade origins of my game are also a feasible demographic.

##### Explanation

The game is suitable for this demographic as it has a high ceiling (there is room for a large amount of skill improvement) however has a low skill floor as the mechanics of a bullet hell are simple to grasp by any person. This means the game can cater to a large audience while pleasing the players that want to push the boundaries of what’s possible in terms of difficulty and spend a lot of time in the game.

To further gather opinions from my target audience I set up a form which I gave out to my peers at my college and other friends online.

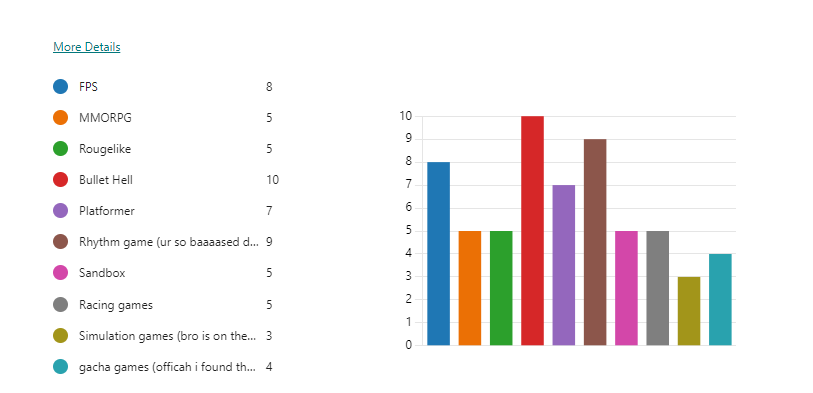
##### Form questions

The questions featured in this form are:

1. How would you describe your time spent gaming per week (in hours)?
2. What game genres have you played and enjoyed?
3. Rate the importance of these features when trying out new games:
   1. Difficulty
   2. Depth of mechanics
   3. Music
   4. Story
   5. Immersion
4. Why do you choose to spend your free time gaming?

##### A white background with black text Description automatically generatedForm responses

The data showed that most people (aged 16-24) spend a large amount of time gaming, meaning they were relatively skilled and would most likely enjoy a game which provides a challenging experience.



A graph with blue bars

Description automatically generated with medium confidenceFurthermore, when asked about people’s preferences in the genre of games being made, the most popular response was bullet hell, which means most stakeholders would have some experience with shoot ‘em up games and thus would expect the challenge accompanying similarly styled games. The second and third most popular game genres were both games that are entirely based on the user’s skill, proving that games that reward skill are popular among my identified stakeholders.

The answers to this question made it apparent that graphics shouldn’t be the main drawing point of my game, which makes sense since that would lock people with weaker hardware out of playing your game. This would in turn make the game less popular to the public.

To clarify about the scale, 1 means the person doesn’t care at all about the game feature, while 5 means the feature plays a big part in if they continue to play the game.

A screenshot of a graph

Description automatically generatedA graph with blue squares

Description automatically generated with medium confidenceWhile some may not always enjoy playing an intense, difficulty focused game, all the time, it is reasonable that there are other slower paced games people play when relaxing. This is also true for games that require a deep understanding of its mechanics. However, when making my game I am assuming people are playing for the thrill and difficulty and are expecting some depth of mechanics that will take time to master.

To clarify, by depth of mechanics I am referring to the number of actions able to be performed at each moment, and the difficulty to perform those. E.g., while a bullet hell might be difficult, its mechanics are usually quite flat as all that is required are movement keys and a button to shoot which is usually just held down since the concept of ammo doesn’t exist.

A screenshot of a graph

Description automatically generated

A graph with blue bars and white text

Description automatically generatedWhile I won’t be marked for the quality of the music in my game, I made sure to feature music from other game OSTs (Original Soundtracks) that I have enjoyed and tried to fit said music to the theme of my game.

However, even though most people expect a good story in the game their playing, this is misleading in the context of my game, since bullet hell games have never included any story since the games were meant to be played repeatedly at an arcade, rather than a singular playthrough something like a movie.

I decided to secretly include a story in the form of lore, though not emphasise or make any direct effort to highlight it when programming my game (the story is loosely being based on a comic I made when I was younger, which most people will not have context on so it shouldn’t distract anyone playing). The story will only be mentioned in lore or niche references that only people that have read my comic to achieve this.

A screenshot of a video game

Description automatically generatedA screenshot of a graph

Description automatically generatedWhat I mentioned above about the inclusion of story can be applied to immersion as well: while people may enjoy immersive/realistic games, people playing bullet hells barely expect any immersion or realism as this is simply not the nature of the genre.

Here I saw that playing with friends is the most popular motivation for gaming, with simply having free time being close behind. This means while making the game somehow multiplayer would definitely attract more customers, I concluded that it was not worth it due to how bullet hells were not designed to be played together meaning not only would I have to come up of a way of making bullet hells multiplayer, but a large amount of development time and recourses (including the cost of running an entire server) would have to be allocated to making this feature as well.

##### Summary

To summarise, based on the form, these are the requirements I ended up setting:

* Minimal focus on graphics
* Large focus on difficulty and gameplay experience
* Make the game replayable
* Add background music
* Add varied interesting mechanics
* Only include lore for people who are looking for it

## Approaching the problem.

##### Inspiration

As mentioned above I have played the bullet hell Touhou extensively and used other games I have played, as well as game design concepts from books I have read to approach the problem. Here I will describe my findings in those games and present my method of making a bullet hell game.

##### Touhou

The Touhou Project is a series of 2D vertically scrolling bullet hell shooting games made by Team Shanghai Alice. They were originally available to play on arcade, however, became available to play on PCs following the rise in availability of computers.

Since there are over 20 games featured in The Touhou Project, I will be referring to ‘Touhou Koumakyou: the Embodiment of Scarlet Devil’, the sixth game in the franchise, as I have the most time spent playing that game. From now on I will refer to this game as simply ‘Touhou 6’.

Touhou 6 feature a set of available characters to pick from which change up the gameplay. Each character has multiple available shot types to pick from e.g. homing bullets in a wide spread, or fast-moving narrow bullets in a straight line.

* The game has only one ‘level’, however the level is split up into stages, which are further split up into sections. Each stage has a theme and background to go along with it, e.g. a vampire mansion of a frozen lake. Each stage is split up into 4 sections.
* Section 1 and 3 consist of hoards of weaker enemies like what you would expect from a classic bullet hell, while stages 2 and 4 feature a singular stronger enemy. Usually, the stage 2 enemy is a weaker version of the boss that prepares the player for stage 4.
* The bosses (strong stage 4 enemies) in Touhou 6 have specific attacks, or bullet patterns that can be learned to improve at fighting the boss. These are identified by ‘spell cards’ that announces the name of the attack. The attack can be either ended by dealing enough damage to the boss, or by running out of time (each spell card starts a timer that ticks down to signify the duration of the attack. The final spell card sometimes cannot be ended by dealing enough damage and must instead by ended purely by surviving the attack.
* The game also features a ‘bomb’ system. This is an expendable resource that deletes all bullets on the screen and makes the character invulnerable for a short period, while dealing massive damage to the enemies on screen. The type of bomb is also dependent on the shot type picked.
* It also features a level system, whereby killing enemies drops a pickup which contribute to levelling up. Levels increase the number of bullets fired by the player, and upon reaching the level cap, all pickups turn into bonus points that reward an extra life after enough has been picked up (life system explained below).
* The game uses a health system, with a life being lost each time the player collides with the enemy. Upon colliding, all enemies and their health persist through death. However, all bullets are cleared from the screen, the player loses some levels and becomes immune to damage for a short period to help prepare for the next attack.
* A handy game mechanic is present in the form of ‘death bombing’ that is triggered by pressing the key to activate a bomb that is available for a tiny period after dying. This will not take any lives away from the player and the game will play out as if the player had bombed to avoid damage instead of getting hit.

From my analysis of Touhou 6, I have decided to implement the following features:

* The player has a set number of lives, with the game ending when the lives reach zero. Justification: having the player’s game end immediately at any mistake will make the game not be fun to learn, so introducing a set amount of lives keeps some difficulty but leaves room for error to learn the game.
* Touching a bullet instantly kills the player and removes a life and resets the position of the user to the bottom of the screen. Justification: In order to have the game’s focus be on dodging bullets, having hitting bullets provide immediate feedback provides an intuitive goal.
* There is some form of ability to make the player invulnerable or assist in defeating enemies. Justification: a special ability provides diversity in the gameplay in that different characters in the game can have different abilities with different benefits. In addition to this an ability to become invulnerable or removing all bullets on the screen provides a way to skip some bullet patterns that are problematic to learn improves the enjoyment of the game.
* Using the ability mentioned within a short timeframe of dying reverts the effects of the death. Justification: Rewarding the player for their reflexes when getting hit by a bullet raises the games skill ceiling and helps remove deaths that would feel unfair to the player.
* There are stages featuring different waves and a set theme.
* Stages feature enemies appearing in waves with a final challenge at the end.
* Attacks from tough enemies will be telegraphed in some way.
* There are multiple characters to select from.
* Characters have multiple types of bullets to choose from.
* Bullets can be upgraded by defeating enemies.

## Making sure to design my game with the limitations my programming method in mind.

## Justifying the software and hardware requirements of my game.

## Tracking the development of my game.

# Design

## Using decomposition to divide my game into smaller problems suitable for OOP and designing the structure of my game.

## Describing the game using game design programming structures and algorithms and justifying the function of these algorithms in reference to my game.

## Identifying, explaining and justifying any inputs used in my game.

# Development

# Evaluation