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# Interactive Digital Art & Design Game Design Document

4<sup>th</sup> Year Project Report

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## Abstract

This project aims to develop an endless runner game inspired by classic Super Mario and Sonic video games with a darker theme inspired by Little Nightmares and Hollow Knight with a pixel art style. The gameplay will be a side-scrolling experience in which the player controls a character that runs from left to right, jumping to avoid obstacles, and using melee attacks to eliminate enemies. The game will track the player's score throughout gameplay and save the best score achieved.

The game will be developed using Node.js which is an open-source, cross-platform JavaScript runtime environment, then Phaser 3 and Tiled, which are powerful game development libraries that allow for easy creation of 2D games. Webpack will also be used it is a JavaScript module bundler that takes multiple JavaScript files and combines them into a single file, reducing the number of server requests and improving the performance of web applications.

The images and sprites will be made in Photoshop, and the audio outside of pre-made files sourced on the internet will be recorded and edited using Audacity to create a unique and immersive experience. The game will be designed to be challenging, with an increasing difficulty level as the player progresses through the game.

A special mention to tiled which will used to create the game's levels and environments. Tiled allows us to easily create and edit tile-based maps, using custom tilesets, adding properties to tiles and objects, and creating multiple layers, it will also be used to export the map in a format that can be read by the game engine, providing an efficient and streamlined level design process.

The game will be built with the goal of providing a fun and engaging experience that combines elements of classic Super Mario and Sonic video games with new and exciting mechanics. Care will be taken to ensure that the game is well-balanced and offers a smooth and satisfying gameplay experience.

## Introduction

The project was chosen because of the popularity and nostalgia associated with Super Mario and Sonic, and the endless runner genre, which is known for its addictive and fast-paced gameplay. These two elements combined will make for a fun and engaging game that appeals to a wide audience. The game will be designed to be challenging, with an increasing difficulty level as the player progresses through the game, making it appealing to both casual and hardcore gamers.

The target audience for the game is primarily gamers who have grown up playing Super Mario and Sonic games, but also anyone who enjoys fast paced and challenging gameplay. The game will be available on multiple platforms, including mobile devices, making it easily accessible to a wide range of players.



## Background

There are several similar games to the one being proposed that are currently available on various platforms. Some examples include:

- **Super Mario Run:** Developed and published by Nintendo, Super Mario Run is an endless runner game featuring the iconic character, Mario. Players control Mario as he automatically runs from left to right and must jump to avoid obstacles and defeat enemies. The game also features a level-based mode in addition to the endless mode, allowing players to collect coins and power-ups. This game will likely influence the proposed project's design in terms of level design and Mario-inspired characters.
- **Sonic Dash:** Developed and published by SEGA, Sonic Dash is an endless runner game featuring the iconic character Sonic. Players control Sonic as he automatically runs from left to right and must jump and slide to avoid obstacles and defeat enemies. The game also features a variety of playable characters, each with their unique abilities. This game will also have a large influence.
- **Subway Surfers:** Developed and published by Kiloo, Subway Surfers is an endless runner game set on a subway system. Players control a graffiti artist who must run from the police and avoid obstacles. The game also features a variety of power-ups and a variety of playable characters.
- **Temple Run:** Developed and published by Imangi Studios, Temple Run is an endless runner game set in an ancient temple. Players control an explorer who must run from a group of monkeys and avoid obstacles. The game also features a variety of power-ups and a variety of playable characters.

## Description

The game is an endless runner inspired by classic Super Mario and Sonic video games with a darker theme inspired by Little Nightmares and Hollow Knight with a pixel art style. The gameplay features side-scrolling action, where the player controls a character running from left to right, jumping to avoid obstacles, and using melee attacks to eliminate enemies. The game also tracks the player's score throughout gameplay and saves the best score achieved. The game is developed using Phaser 3 and Tiled, with custom-made images and sprites, and audio that is recorded and edited manually.

In terms of technical achievements, the game demonstrates the ability to use Phaser 3 and Tiled to create a 2D side-scrolling game. This includes implementing character movement, collision detection, and enemy AI. The game also implements a scoring system and a save system to track and save the player's best score. Additionally, the game uses custom-made images and sprites, and audio that is recorded and edited manually to create a unique and immersive experience.

In terms of personal achievements, the game represents the ability to learn and implement game development skills. This includes understanding the game development process, from design to implementation, and working with game development libraries such as Phaser 3 and Tiled. The game also demonstrates the ability to create custom assets, such as images and sprites, and audio. Additionally, the game represents the ability to work independently and manage time effectively to complete the project.

## Game Overview

### Philosophy

Philosophically, the game can be seen as an attempt to create an engaging and entertaining experience for the player. The game combines familiar elements, which are beloved by many, with new and exciting mechanics to create an experience that is both nostalgic and fresh. The endless runner genre is known for its addictive and fast-paced gameplay, and by adding a scoring system and a save system, the game aims to motivate the player to improve their performance and achieve a high score.

Additionally, the game can also be seen as an attempt to challenge the player and provide them with a sense of accomplishment. The game increases in difficulty as the player progresses through it, making it appealing to both casual and hardcore gamers. The game's mechanics and design aim to provide a sense of satisfaction and enjoyment when the player overcomes obstacles and achieves a high score.

Overall, the game's main goal is to provide an enjoyable and engaging experience for the player, that combines nostalgia and new mechanics, challenging gameplay and a sense of accomplishment and satisfaction.



## Common Questions

### What is the game?

The game is an endless runner inspired by classic Super Mario and Sonic video games. Players control a character running from left to right and must jump to avoid obstacles and use melee attacks to eliminate enemies. The game tracks the player's score and saves the best score achieved. The game is developed using Phaser 3 and Tiled, with custom-made images, sprites, and audio.

The game aims to provide a fun and engaging experience that combines elements of nostalgia with new mechanics and challenges the player with an increasing difficulty level as they progress through the game as well as an exciting them and story.

### Why create this game in particular?

The game will hit a target market that is beloved by many. As the designer I wanted to play with familiar mechanics that I've played with all my life but put my own spin and experience behind using my own artistic touches and flourishes while still hitting that nostalgic feeling of the old Mario games. Furthermore, this game provides the opportunity to explore and apply game development skills, art skills and provide a valuable learning experience for me as a developer, designer, and artist.

### Where does the game take place?

The setting of the game is a dark and gothic forest that takes inspiration from games like Hollow Knight. The player will find themselves navigating through a dense, misty forest filled with twisted trees and gnarled branches. The forest is bathed in a dim, eerie light, casting long shadows and creating a sense of unease.

The atmosphere is further enhanced by the sound of howling winds and the distant calls of unknown creatures. The player will have to overcome obstacles and enemies to progress through the game. The game's design is inspired by the art style of games like Hollow Knight, Little Nightmares and Towerfall, featuring hand-drawn 2D graphics with a dark, atmospheric aesthetic.

### What do I control?

In the game you control yourself, the main character as you try and survive. You will be able to jump and attack when needed to prevent the game from ending and enhance your score as best you can.

### What is the focus?

The focus of the game is to simply survive from a mechanics point of view. From a story point of view the game will open with a loved one being taken from you, and you traverse the forest environment to chase down those who took them from you and be reunited.

### What is different?

I think the art style and story sets it apart from similar games. Though a lot of the mechanics will be familiar the style, the animation, the effects, the sounds will really make it stand out from the crowd.

## Feature Set

Dark gothic art style	Multiple enemy types	Smooth travel mechanics
Individual sprites	Many obstacle variations	Attack animations
Well-developed animations	High score and leader board	Pixel art style
Intricate storytelling	Exciting gameplay	Increasing difficulty
Forest environment	Voice acted	Audio enhanced

# The Game World

## Location

The physical game world is a dark and gothic forest, characterized by twisted trees, gnarled branches, and a dim, eerie light. The forest is covered in mist and shadows, creating a sense of unease and uncertainty. The trees are tall, their branches stretching out like clawed fingers, and the leaves are dark and twisted, giving the impression that the forest is alive and hostile.

The forest floor is littered with twisted roots and rocks, and the player will have to navigate through it as they progress through the game. The game's art style is hand-drawn 2D, with a focus on details, contrasts, and a sense of depth. The colour palette is mostly dark and muted, with shades of brown, grey, and dark green, that gives a sense of mystery and danger.

## Travel

In the game, the player will move the character from left to right automatically, like most endless runner games. The player will control the character's movement by making it jump to avoid obstacles and using melee attacks to eliminate enemies. The player can also perform different types of jumps, such as a double jump, and a freefall to navigate through the game's environment.

## Scale

Overall, the game will have a relatively small scale, focusing on providing a challenging and engaging endless runner experience through a side-scrolling environment, with the aim of improving the player's score and saving it as the best score.

There won't be any vast open worlds but as explained in the location section the endless forest and its infinity will be all the scale needed, a lone sprite tearing through the darkness.

## Objects

There will be several types of objects present in the game, including:

- **Obstacles:** The player will encounter various obstacles such as rocks, branches, and other hazards that they will need to jump over or avoid to progress through the game.
- **Enemies:** The player will also encounter various types of enemies such as skeletons, monsters and other hostile entities that they will need to eliminate using melee attacks.
- **Background elements:** Various background elements such as trees, rocks, and other natural elements that will help to create an immersive and believable game world.

## Weather

The game is set in a dark and gothic forest, so the weather will be quite gloomy and eerie, with a misty and dim atmosphere. The game will feature a variety of weather effects such as:

- **Fog:** The forest will be covered in thick fog that will obscure the player's vision, making it harder to see obstacles and enemies.
- **Rain:** The game will feature light rain or drizzle effects, adding to the gloomy atmosphere of the game.
- **Wind:** The game will feature a howling wind effect that will add to the sense of unease and uncertainty in the game.

The weather effects will be used to enhance the atmosphere and make the game world more believable and immersive, but they will not affect the gameplay directly. They will not make the game harder or easier, but they will make the game more immersive and believable.

## Rendering System

The game will be rendered using WebGL, a JavaScript API that allows for interactive 3D and 2D graphics in web browsers, as well as Phaser 3, a popular open-source game development framework that uses WebGL to render games.

When the game is run, Phaser will initialize the WebGL context and set up the necessary buffers and shaders for rendering the game's graphics. The game's assets, such as images and sprites, will be loaded and prepared for rendering. The game's objects and characters will be rendered as sprites, which are 2D images that can be positioned, scaled, and rotated on the screen.

Phaser will use a technique called batch rendering to optimize the performance of the game. This means that it will group similar objects together and render them in a single draw call, reducing the number of times the GPU needs to be accessed and improving performance.

The game's lighting and particle effects will also be rendered using WebGL. Phaser supports the use of shaders, which are small programs that run on the GPU to create special effects such as lighting, reflections, and animations. The game will use these shaders to create atmospheric lighting and particle effects that enhance the game's visuals.

## Camera

The camera in the game will be a fixed, side-scrolling camera that follows the player's character as they move from left to right. The camera will be positioned in such a way that the player can see a certain portion of the game world at a time. This approach is common in side-scrolling games, as it allows the player to see what is coming up ahead and react accordingly.

The camera will also move with the player's character, so as the player moves to the right, the camera will move with them, revealing more of the game world. The camera will not be able to rotate or zoom, it will keep the same angle and field of view throughout the game.

Additionally, the camera may also have some visual effects such as screen shake, blur or a small amount of movement to enhance the sense of action and immersion, or to emphasize certain actions or events in the game.





## Game Engine

The game engine for this game is Phaser 3, which is a popular open-source game development framework for creating 2D and 2.5D games. It uses WebGL and Canvas for rendering graphics and provides a comprehensive set of tools for handling physics, animation, particle effects, as well as tilemap support. It also offers a streamlined development process with an intuitive and easy-to-use API, allowing for quick prototyping and iteration.

Additionally, Phaser has a large and active community that provides support and resources. Overall, Phaser 3 is a powerful and versatile game engine that enables the development of immersive and engaging 2D and 2.5D games with minimal effort.

The game engine, Phaser 3, will work as the backbone of the game, providing the necessary tools and functionality for creating and running the game. The engine will handle the initialization of the game, the loading of assets, and the management of the game's objects and logic.

The engine will handle the game's physics, such as collision detection and character movement, using its built-in physics engine. It will also handle the game's animation, allowing for smooth and fluid movement of characters and objects.

The engine will also handle the game's input, such as player's actions, using its built-in input management system. It will also handle the game's rendering, displaying the game's graphics on the screen using WebGL and Canvas. The engine will also handle the game's score tracking and best score saving, using its built-in score management system.

Overall, the game engine will provide the necessary tools and functionality for creating and running the game, handling the game's physics, animation, input, rendering, score tracking, and best score saving, allowing for more time to focus on the game's design and gameplay.

## Collision Detection

The game engine, Phaser 3, handles collision detection using its built-in physics engine. This physics engine uses a variety of collision detection algorithms to determine when two objects in the game have collided.

One common algorithm used by Phaser is the Separating Axis Theorem (SAT) which tests for the overlap of two objects by projecting their shapes onto multiple axes and checking for overlap. This algorithm is useful for detecting collisions between convex shapes, which is common in 2D games.

Another algorithm used by Phaser is the Pixel Perfect Collision Detection, which checks for collision by comparing the pixels of two sprites, this algorithm is useful for detecting collision between non-convex shapes and for accurate collision detection in pixel art games.

In addition to these algorithms, Phaser also provides other collision detection features such as collision groups, which allow the developer to organize objects and optimize the collision detection process, and collision call-backs, which allow the developer to define custom behaviour when a collision is detected.

Overall, Phaser 3 handles collision detection using a variety of algorithms such as Separating Axis Theorem (SAT) and Pixel Perfect Collision Detection, as well as other features like collision groups and collision call-backs, allowing for accurate and efficient collision detection in the game.

## Game Characters

### Main Characters

The story features a couple, named Alex and Mia. Alex is a determined and brave individual, who is deeply in love with Mia. He is a strong and athletic person, who is not afraid to face challenges and risks his own safety to protect his loved ones. He is also a skilled fighter, able to use his fists and any weapon he can find to defend himself.

Mia is a kind and caring person, who is deeply in love with Alex. She is a smart and resourceful person, who can think on her feet and improvise when needed. She is also a strong and resilient person, who can face adversity and come out on top.

### Enemies

The forest in the game is a dark and gothic place, filled with dangerous creatures and hostile entities. In this case, the forest is filled with Skeletons, undead and cultists who summon them all. Here are a few examples of these entities:

- **Skeletons:** These are the remains of dead creatures or humans, reanimated by dark magic. They are fragile but fast, and they can use swords, they were buried with. They can also use their bones as projectiles to attack the player from a distance.
- **Zombies:** These are the remains of dead creatures or humans, reanimated by dark magic, they move slowly and have low intelligence, but they are relentless, they can attack with their decaying hands.
- **Cultists:** These are humans who worship the forest's dark powers and summon the undead. They are armed with knives and other simple weapons, and they can use dark magic to summon skeletons or zombies, to protect themselves or to attack the player.
- **Necromancer:** A powerful cultist who has dedicated his life to the dark powers, they are the ones behind the summoning of the undead. They can summon hordes of skeletons and zombies, and they can also use dark magic to attack the player directly.

## User Interface

The user interface for the game will be designed to be intuitive and easy to use, while also being visually pleasing and in line with the game's aesthetic. The UI may contain:

- **Score:** A text on the top-right corner of the screen will show the player's current score. The score will increase as the player progresses through the levels, defeats enemies, or collects items.
- **Lives:** A set of icons in the top-left corner of the screen will represent the player's remaining lives. Each icon will be a representation of the player's character, and as the player loses lives, the icons will disappear.
- **Pause menu:** A menu that will appear when the player pauses the game, it will allow the player to access the settings and exit the game.

The UI will use a simple colour palette and minimalistic design to ensure that it does not distract the player from the gameplay, and it will be consistent throughout the game, to maintain a sense of continuity and immersion.

## Weapons

The main character, Alex, will use a sword as his primary weapon in the game. The sword will be a versatile weapon, allowing him to perform quick and powerful attacks. The sword will also be able to deflect projectiles, making it a useful tool for defence as well.

The enemies in the game will use a variety of weapons and attacks. Here are a few examples:

- **Bones:** Some enemies, such as skeletons, will use bones as projectiles, throwing them at the player from a distance. These bones can be deflected by the player's sword, making it important to pay attention to the enemy's attacks and timing.
- **Fists:** Some enemies, such as Zombies, will use their fists to punch the player. These attacks will be slow but powerful, and they will be able to knock the player back.
- **Energy blasts:** Some enemies, such as Necromancers, will use energy blasts to attack the player from a distance. These blasts will be fast and difficult to avoid, making it important for the player to dodge or deflect them.
- **Swords:** Some enemies, such as Cultists, will use knives and swords to attack the player.

Overall, the enemies in the game will use a variety of weapons and attacks, from bones, fists and energy blasts to swords, making it important for the player to pay attention to the enemy's actions and use their own weapons effectively to defeat them.

## Music and Sound Effects

There are several free resources that can be used for the game's audio and music. Here are a few examples:

- **Freesound.org:** This website contains a large library of free audio samples that can be used for sound effects in the game, such as footsteps, sword clashes, and enemy death sounds. The audio samples can be downloaded and used in the game with proper attribution.
- **OpenGameArt.org:** This website contains a library of free game assets, including music and sound effects. It's a community-driven site, so the quality of the assets can vary, but there are a lot of high-quality options available as well.
- **Bensound.com:** This website offers a collection of royalty-free music tracks that can be used for the game's background music. The tracks are divided into different genres and can be easily searched and previewed before downloading.
- **Incompetech.com:** This website offers a collection of royalty-free music tracks and sound effects that can be used for a variety of projects, including games. The site has a wide range of genres and styles to choose from, including orchestral, electronic, and ambient music.

Overall, the sound design will play a crucial role in immersing the player in the game world, and conveying information about the game's mechanics, it will be a combination of ambient sounds, sound effects, music and voice acting, all working together to create a rich and immersive experience for the player.

## Single-Player Game

The single player experience will be an exciting and engaging journey through a dark and gothic forest, where the player will explore, fight, and progress through the level, all in the pursuit of saving their love. The single player experience of the game will include several key components:

**Exploration:** The player will be able to explore the dark and gothic forest, and discover new areas as they progress seeing different sections of the game map the further into the forest they go.

**Combat:** The player will engage in fast-paced combat against a variety of enemies, using a sword as the primary weapon.

**Storyline:** The player will follow a story that revolves around Alex's quest to save his beloved Mia, who got taken away by an unnamed enemy who taunts the player throughout.

**Progression:** The player will move through the level and feel a progression in their attempts to get a higher score and get further and further into the forest.

**Audio-Visual experience:** The game will provide an immersive audio-visual experience with rich sound design, detailed graphics and dynamic music that will change depending on the situation.

## Story

At the start of the game, Alex and Mia are out for a walk in the forest when they are ambushed by an enemy. Alex fights bravely to protect Mia, but he is outnumbered and overpowered, and Mia is taken away by the enemy. Alex, determined to save her, becomes the player character, and sets out on a journey to rescue Mia from the clutches of the enemy.

The enemy will taunt the player at different key stages in the game, all while the background devolves into even darker more sinister areas of the forest.

## Character Rendering

To create the characters, I will be using a combination of hand-drawn images and 3D models which will be carefully animated to create realistic and expressive movements. I will also be taking advantage of the features of WebGL such as lighting, shading, and reflections to enhance the visual quality of the characters.

To optimize the performance of the game, I will be using sprite sheets, which allow me to pack multiple sprites into a single image, thus reducing the number of file requests.

Overall, using Phaser 3 and WebGL, I will be able to create visually stunning and expressive characters that will be a key component of the game's immersive experience. I will also use techniques to optimize the game's performance, to ensure that the game runs smoothly and efficiently.



## Project Milestones

My first milestone for this game project would be the concept and design phase. This would involve creating the game's story, characters, levels, mechanics, and overall aesthetic. This includes designing the main characters, enemies, weapons, abilities, and creating a detailed game design document.

The next milestone would be the prototype phase, where I will work on creating a working prototype of the game. This will involve implementing the basic mechanics such as jumping, running, and melee attacks and creating a small portion of the levels to test the mechanics and gather feedback.

The next milestone would be the Alpha version, where I will work on implementing all the core mechanics, most of the levels and most of the assets. This version will be used for internal testing and to gather feedback.

The next milestone would be the Beta version, where I will work on polishing the game, adding all the levels, all the assets, and all the features. This version will be used for external testing and to gather feedback.

The next milestone would be the final version, where I will work on adding the final polish, and fixing any bugs that were found during testing.