

QUATERNARY

Educational Video Game About Genetics

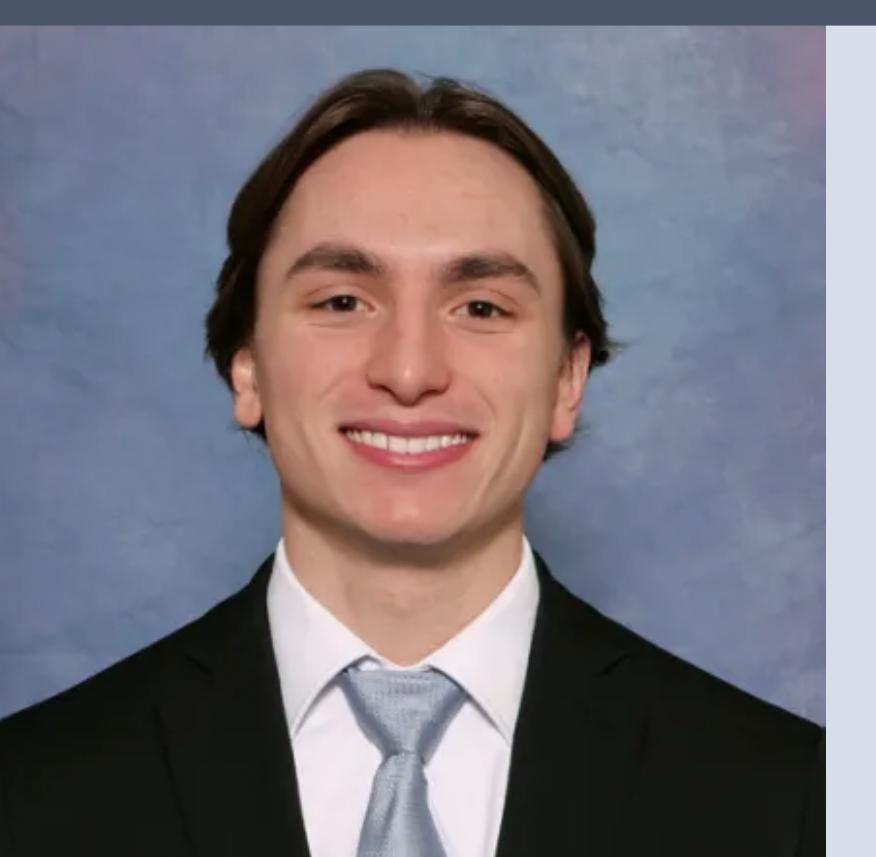
University of Cincinnati Senior Design Project
Computer Science Class of 2024



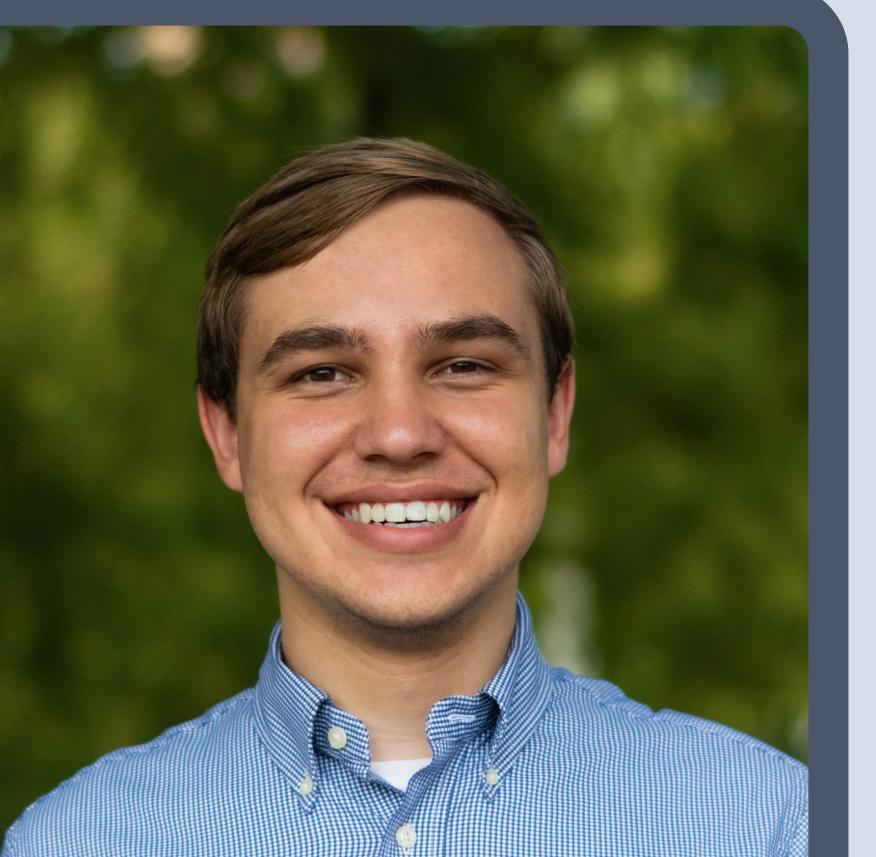
Connor McKinney
Computer Science



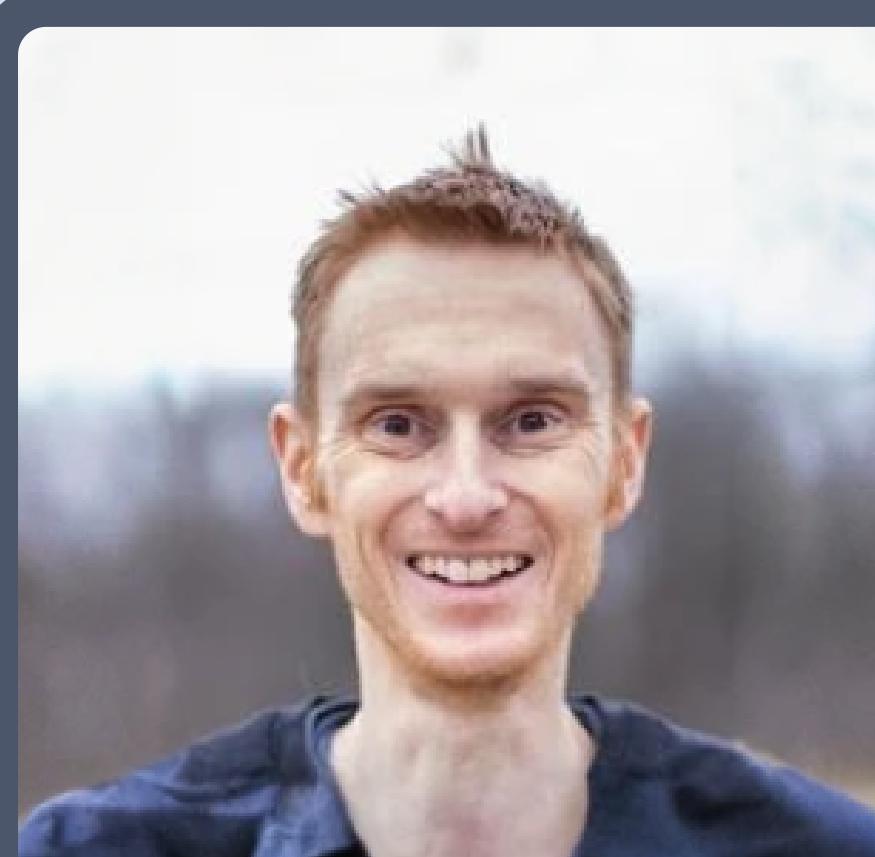
David Lewis
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Johnathan Whiting
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Leendert van't Riet
Composer

Development Team

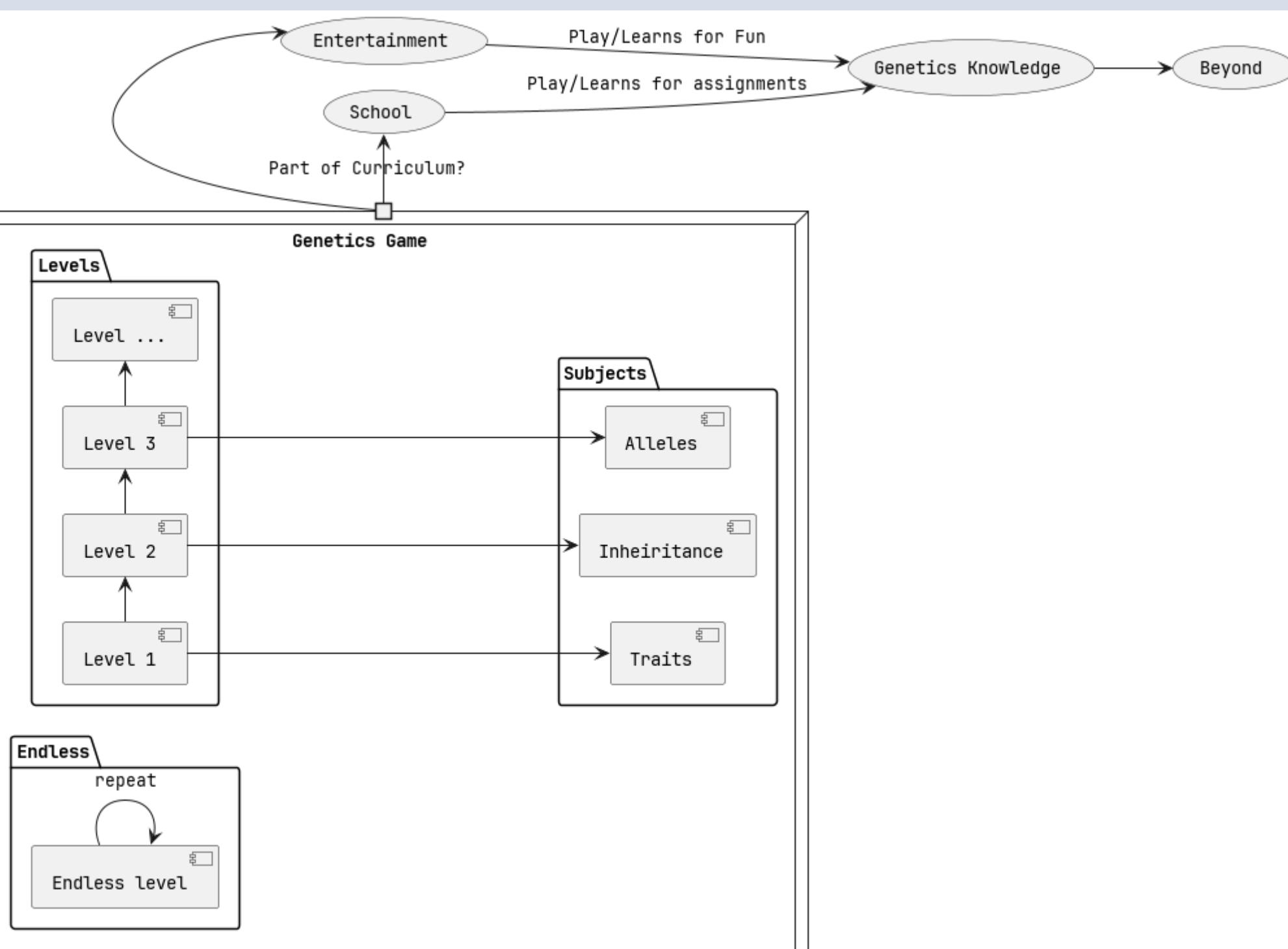
Our Mission

Educational video games frequently fail to balance both fun and learning, often delivering dry content in unengaging formats. Accessibility is also often overlooked, resulting in confusing controls and interfaces that can exclude a wider audience.

Quaternary seeks to revolutionize biological education by offering a highly engaging experience that prioritizes both enjoyment and deep understanding. Quaternary features intuitive controls and user-friendly interfaces, ensuring accessibility for all learners. Through immersive gameplay, players will actively explore and master concepts relating to genetics, cultivating a lifelong love of learning.

Design Philosophy

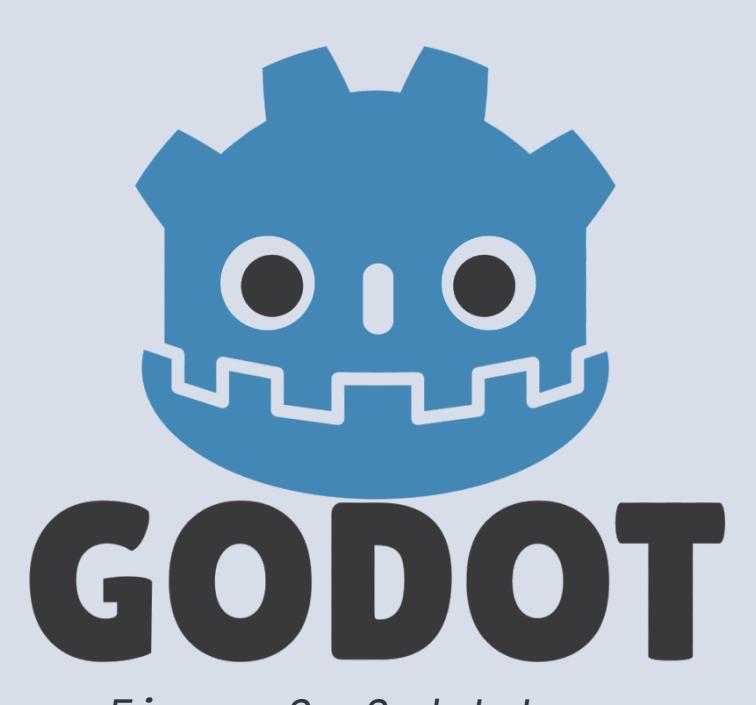
Biology is a broad topic, so we decided to focus on genetics. Quaternary is primarily targeted towards high-school-aged children that are taking a biology class. With this in mind, Quaternary teaches genetics concepts that include traits, alleles, genes, inheritance, and evolution.



When creating an educational game, accessibility is a major priority. To account for this, Quaternary includes international language features, a mouse-focused user interface, and color-blind design philosophy. This ensures that anyone willing to learn will be able to intuitively point and click with their mouse.

Tools

Engine - Godot 4.1 & 4.2



We decided to choose Godot as our game engine. We liked its built in language (Godot Script), its suitability for 2D top-down games, its open source nature, and its built in IDE. It is also very beginner friendly, which was ideal as this was collectively our first video game.

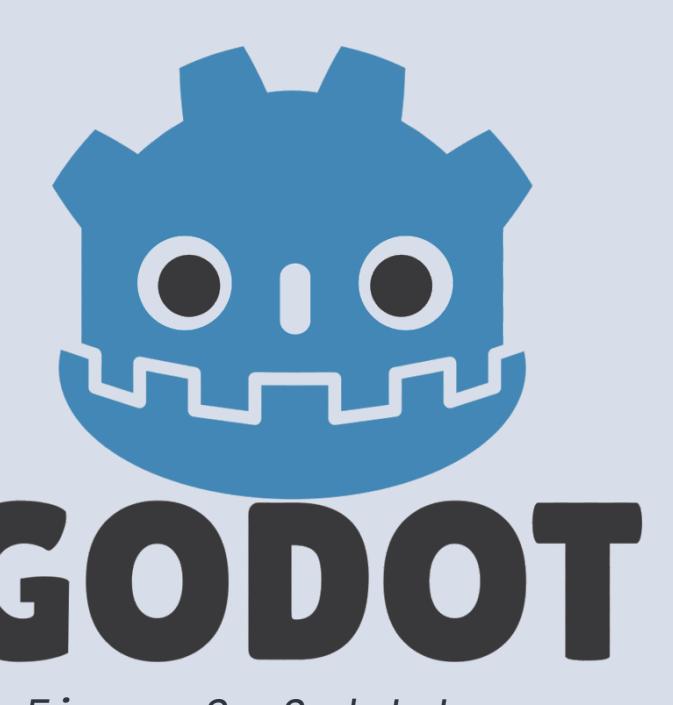


Figure 2: Godot Logo

Art - Blender



Figure 3: Blender Logo

We used Blender to generate most of the art assets utilized within the game. Many assets were able to be procedurally generated within Blender, which can be seen below.

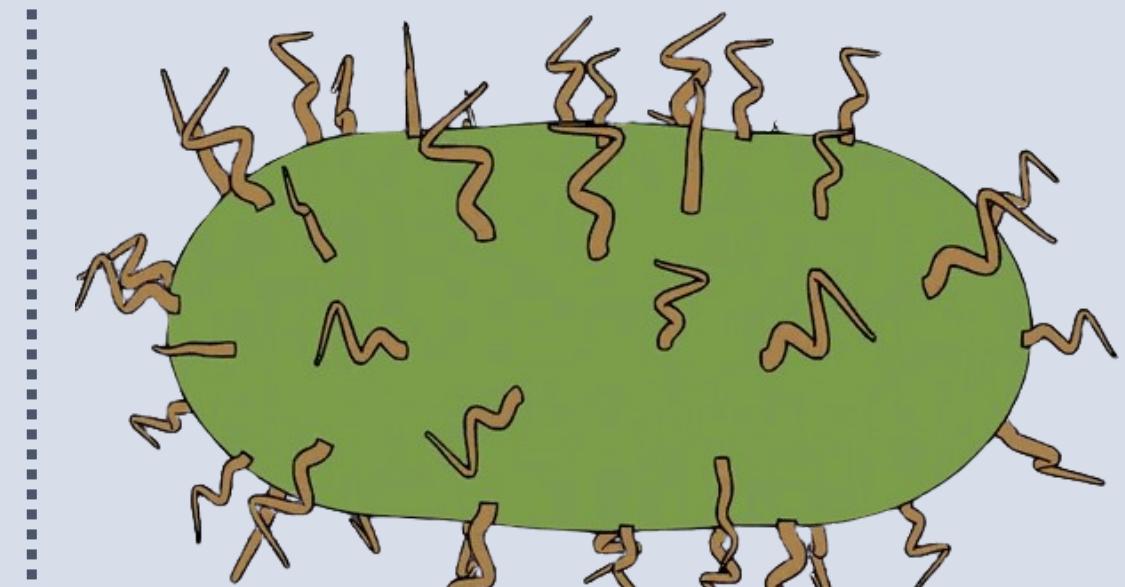


Figure 4: Bacteria

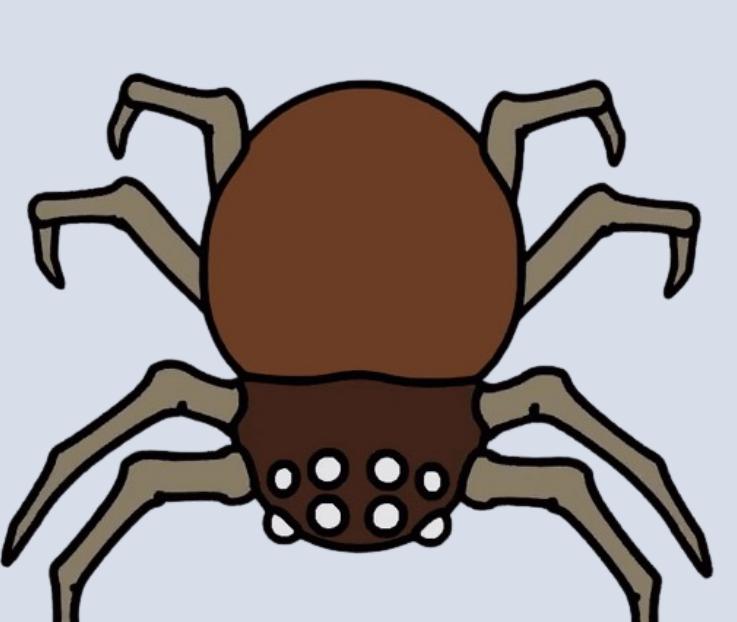


Figure 5: Spider

Project Management - Github



Figure 6: Github Logo

Github was used to store information related to the project as well as version control. We utilized automated pipelines to verify code integrity for all pushes.

Sound Design

Sound design for Quaternary was undertaken by Leendert van't Riet, who graciously donated his time and skills as a composer to design a custom soundtrack as well as sound effects for Quaternary using Logic Pro.



Figure 7: Logic Pro Logo

Quaternary's soundtrack largely incorporates ambient and electronic themes, which suit the subject matter well.



Figure 8: Logic Pro Interface

Development Process

Early Development

Godot combines 2D/3D graphical editors with script editors in its built in IDE.

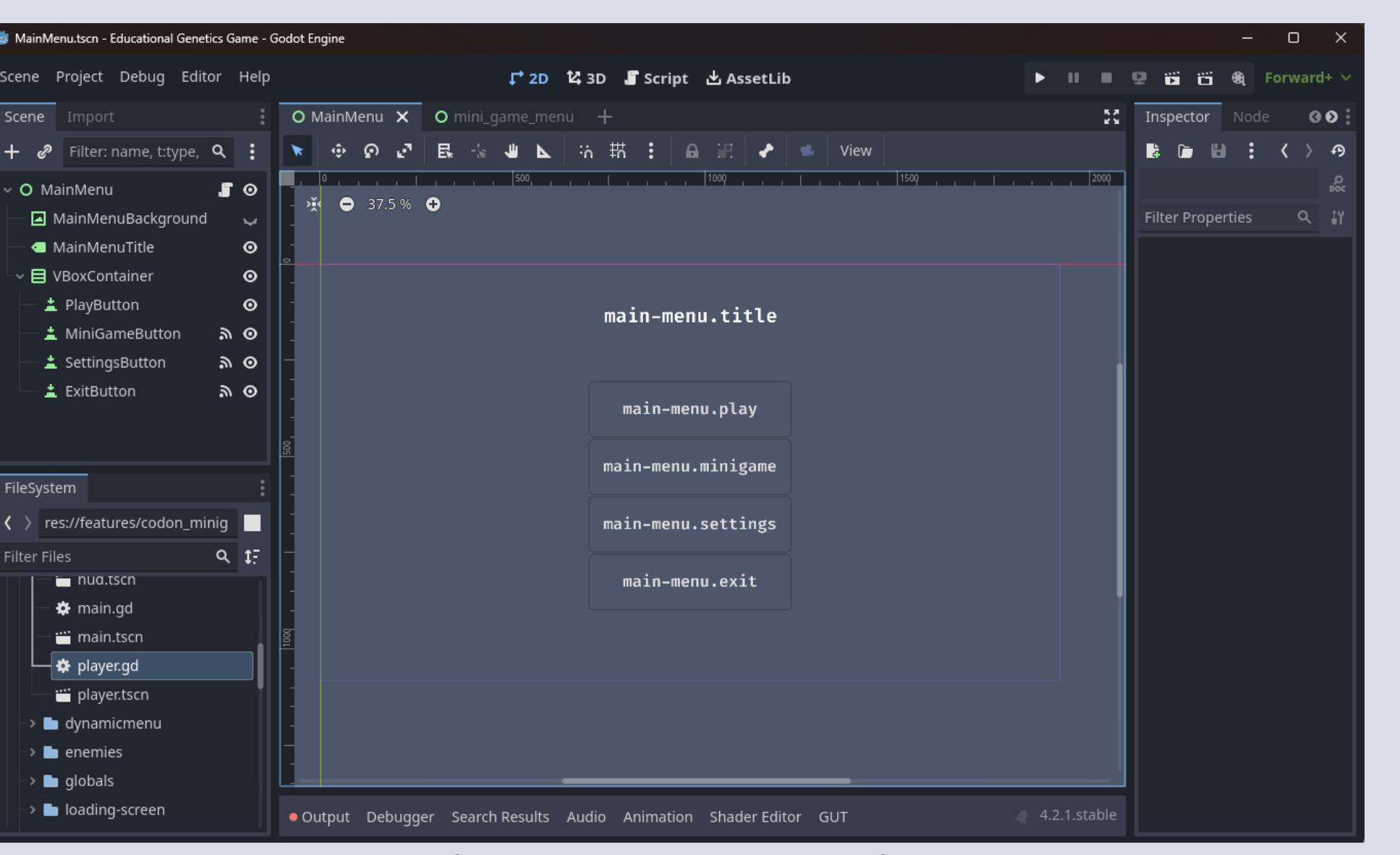


Figure 9: Godot IDE 2D View

We completed the official Godot Tutorial to learn how to best use the IDE, as well as things like signals and global theming.

Mini-Games & Main Game

To start main development, we all decided to create a mini-game covering a different concept within genetics, each added to the final game.

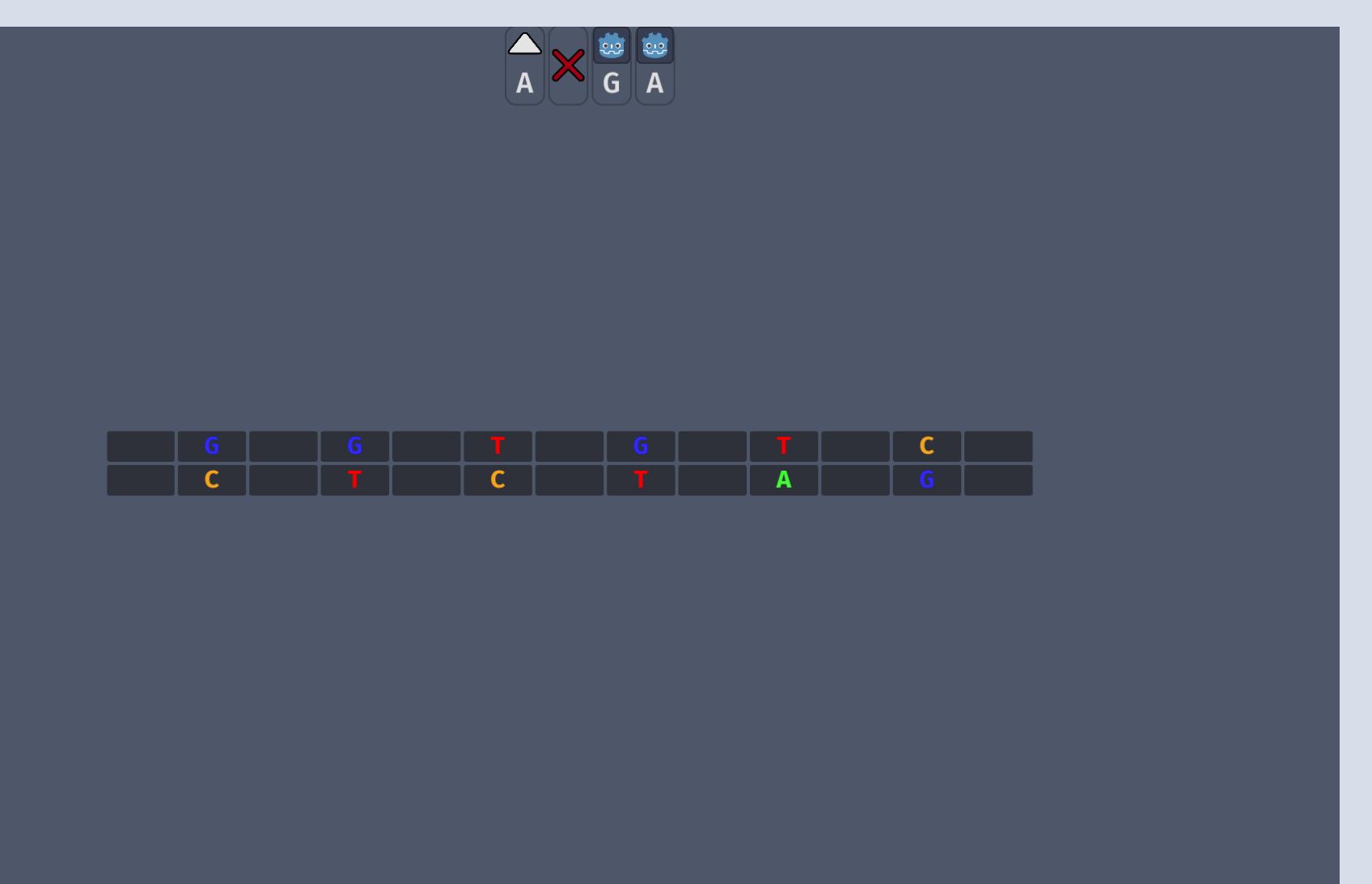


Figure 10: Mutation Mini-Game

This experience allowed us to kick-start development of the final game. We created a complex trait system utilized in the main game to teach players core concepts of genetics. This system allows players to take control of a population, select different traits, and see the effects unfold in real time.

Additional Considerations

To ensure accessibility, we developed Quaternary to allow for full translation to multiple languages. We also implemented unit tests using a library called GUT.

Challenges

Type Safety

One of the requirements we established for ourselves was to select a language that could be type safe. We were eventually able to achieve this with strongly typed variables and function declarations in our scripts.

Mouse Focused Design

Quaternary's mouse focused design, while great for accessibility, made it quite a challenge to design engaging and educational game-play. We had to be quite creative with our design to get around this self-imposed limitation.

Transition To Game Development

Quaternary was the first video game that each of us have worked on. While it was a fun process, we found that our biggest challenge was learning how to transfer our software development skills into game development. We discovered that it takes more than strictly programming skills to be a good game designer. Quaternary challenged each of us in different as well as similar ways and allowed us to greatly grow our creative thinking skills.

Future Plans

Updates & Additional Content

Our main plans for the future of Quaternary consist of adding onto the main content of the game in the form of additional levels. We feel that providing the game with consistent updates will both maintain and grow the game audience.

In addition to content updates, we also plan to monitor bugs and regularly provide patches.

Publishing To A Platform

One of our initial goals that temporarily fell by the wayside was that of publishing Quaternary on a game platform like Steam or the Google Play store. This would increase the outreach of the game while also potentially creating a community of players.