Simulating evolution in a puzzle game.

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Computer Science with Games Technology

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Word Count:

# Agreed Arrangements

* Not agreements have been made so far

# Introduction

# Project Proposal

## Problem to be solved

* Creating a puzzle/simulation game where the player must create a species that can survive in the levels environment.
* Look towards Dwarf Fortress for the simulation of each individual in the species.
* Idea is to create a set of rules for indiviuals, that when combined lead to complex behaviour.
* Will be using neural nets to simulate individual choices – Look to NEAT and RENEAT algorithms for evolution.
* Find other simulation games this is similar to. EG Spore

## Project Objectives

* Main Goal: This project shall give the end user a game experience where they create a species that can survive and evolve in a given level environment.

## Project Beneficiaries

* Myself: I want to play a simulation game where I can see a species evolve.
* There is recent demand for games such as this so potentially it will be beneficial to a broader range of game players

## Work Plan

* Will be created using C++, SDL and Open\_GL. This will be done so I can do matrix calculations on the GPU via shaders. Also using C++ will allow me to fine tune performance. SDL will be used to communication between hardware and Open\_GL.
* MVP goals:
  + Create a rendering system to display 2D sprites and a tilemap. The 2D sprites will not need to be applied to a phsyics system, as their movement will be from tile to tile. The tilemap needs to be modifiable during runtime to allow for buildings and such to be put ontop.
  + Create a simple camera that has function to move around the map with mouse/keyboard controls and can zoom in and out.
  + Create a simple UI system that consists of a render layer that renderes separately to the game layer and uses screen cords to render text and ui elements where needed.
  + Create a neural net system that runs for each individual and defines what they want to do in a simulation step. EG. Person A is hungry -> The net decides they should eat.
    - Define inputs to the net. This will be things like current emotions, sensory information, meta information(distance to food, amount of food in storage, amount of homes…)
  + Create a system in which the net can evolve to include new potential decisions. The new potential decisions are what I will call the Gene Pool. The new evolutions can either be random, or player defined using some sort of evolution point. EG. One person has a child and this child randomly develops the idea to climb trees, this allows them to see further. OR. The player knows there is going to be a snow storm soon, and so forces the decision to Build a Home onto their species. OR. The player knows there is a snow storm, and so evolves a new characteristic, resistance to cold.
  + Create a world generation thats able generate a random world and to create natural disasters that the player must work around. EG. Volcanos, Snow storms, desert/lack of food and water, high preditor envrioments.
  + Create a species creation screen. This must allow the player to define some initial characteristics eg: height, metabolism, count of eyes… It must also allow the player to define an initial decision net, eg: the species knows how to dig underground, build a home, search for food, fight. This initial species creation will be capped with a points system, where some characterists will add to the total and some will subtract.
  + Source/Create some basic sprites that display the required information. This includes things like: Characters, environment, buildings, items..
  + Create a level in which the species has to survive a natural disaster that is coming in 100 years.
* Extra Goals:
  + Create a world generation algorithm that can handle different kind of biomes
  + Create a layered tilemap so that more then one elevation can be created. Look at dwarf fortress for what I mean.
  + Expand the UI system to allow for animations
  + Expand the UI system to allow for anchoring elements to screen positions rather then exact cords. This will allow for a resizable screen.

## Project Risks

### Risks to your project

* Computer breakdown/loss of work – Daily uploads to a git repo with my most recent work.
* Over complexity leads to not being able to finish the project – Focusing on the key evolution aspect first before creating levels. At the end I can then deliver a “sandbox” experience with the key gameplay element. A sandbox experience would just be a randomly generated world and a created species, but with no goal in mind.
* Project is too resource demanding to run on low spec machines – Reguarly test on both my high end machine and on a much lower spec machine. If required for further testing, I can spin up a virtual machine on the cloud with the specs I want.
* Lack of understanding creating an Open\_GL/SDL framework from the goundup – Already taking steps to mitigate this by creating practice projects of simple games, Flappy birds, Pacman and a Tower defence.
* Lack of experience creating neural nets that provide a fair and fun gameplay experience – Start to work on this aspect as early as possible so I can experiment and learn as I create it. OR scrap the neural net idea and have the individuals simulated using a decision tree. I will have to allow time for this in my planning if I need to swap ideas. This area will likely take 4-6 weeks.

### Risks that your projects poses to others

* Potential for abuse by creating a species that looks similar to something real and then treating it badly. – This will be mitigated because a lot of what the species will do is not controlled by the player and so they can only define how they evolve. There will also be no way to evolve ethically bad decisions, eg slavery, sexual abuse, bullying will not be included as a possibility.
* Project taken out of proportion that it accurately simulated evolution – I will add a clear warning that it is no an accurate simulation but one created for a game.

# Ethics Checklist