Simulating evolution in a puzzle game.

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Computer Science with Games Technology

Consultant Name: Chris Child

Proposed By: Alexander Sowatskey Twaddell

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 level’s environment.
* Look towards Dwarf Fortress for the simulation of everyone in the species.
* Idea is to create a set of rules for individuals, that when combined lead to complex behavior.
* Will be using neural nets to simulate individual choices – Look to NEAT and RENEAT algorithms for evolution.
* Find other simulation games this is like. 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 each 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 physics 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 on top.
  + 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 renders 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, number 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 that’s 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 predator environments.
  + 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 must 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 defense.
* 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

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| --- |
| **Research Ethics Review Form: BSc, MSc and MA Projects**  **Computer Science Research Ethics Committee (CSREC)**  <http://www.city.ac.uk/department-computer-science/research-ethics> |

Undergraduate and postgraduate students undertaking their final project in the Department of Computer Science are required to consider the ethics of their project work and to ensure that it complies with research ethics guidelines. In some cases, a project will need approval from an ethics committee before it can proceed. Usually, but not always, this will be because the student is involving other people (“participants”) in the project.

In order to ensure that appropriate consideration is given to ethical issues, all students must complete this form and attach it to their project proposal document. There are two parts:

***PART A: Ethics Checklist***. All students must complete this part. The checklist identifies whether the project requires ethical approval and, if so, where to apply for approval.

***PART B: Ethics Proportionate Review Form****.* Students who have answered “no” to all questions in A1, A2 and A3 and “yes” to question 4 in A4 in the ethics checklist must complete this part. The project supervisor has delegated authority to provide approval in such cases that are considered to involve MINIMAL risk. The approval may be ***provisional*** *– identifying the planned research as*likely to involve MINIMAL RISK. In such cases you must additionally seek ***full approval*** from the supervisor as the project progresses and details are established. ***Full approval*** must be acquired in writing, before beginning the planned research.

**Part A: Ethics Checklist**

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| --- | --- | --- |
| **A.1 If you answer YES to any of the questions in this block, you must apply to an appropriate external ethics committee for approval and log this approval as an External Application through Research Ethics Online - https://ethics.city.ac.uk/** | | *Delete as appropriate* |
| 1.1 | Does your research require approval from the National Research Ethics Service (NRES)?  e.g. because you are recruiting current NHS patients or staff?  If you are unsure try - https://www.hra.nhs.uk/approvals-amendments/what-approvals-do-i-need/ | **NO** |
| 1.2 | Will you recruit participants who fall under the auspices of the Mental Capacity Act?  Such research needs to be approved by an external ethics committee such as NRES or the Social Care Research Ethics Committee - http://www.scie.org.uk/research/ethics-committee/ | **NO** |
| 1.3 | Will you recruit any participants who are currently under the auspices of the Criminal Justice System, for example, but not limited to, people on remand, prisoners and those on probation?  Such research needs to be authorised by the ethics approval system of the National Offender Management Service. | **NO** |
| **A.2 If you answer YES to any of the questions in this block, then unless you are applying to an external ethics committee, you must apply for approval from the Senate Research Ethics Committee (SREC) through Research Ethics Online -**  **https://ethics.city.ac.uk/** | | *Delete as appropriate* |
| 2.1 | Does your research involve participants who are unable to give informed consent?  For example, but not limited to, people who may have a degree of learning disability or mental health problem, that means they are unable to make an informed decision on their own behalf. | **NO** |
| 2.2 | Is there a risk that your research might lead to disclosures from participants concerning their involvement in illegal activities? | **NO** |
| 2.3 | Is there a risk that obscene and or illegal material may need to be accessed for your research study (including online content and other material)? | **NO** |
| 2.4 | Does your project involve participants disclosing information about special category or sensitive subjects?  *For example, but not limited to: racial or ethnic origin; political opinions; religious beliefs; trade union membership; physical or mental health; sexual life; criminal offences and proceedings* | **NO** |
| 2.5 | Does your research involve you travelling to another country outside of the UK, where the Foreign & Commonwealth Office has issued a travel warning that affects the area in which you will study?  *Please check the latest guidance from the FCO -* [*http://www.fco.gov.uk/en/*](http://www.fco.gov.uk/en/) | **NO** |
| 2.6 | Does your research involve invasive or intrusive procedures?  These may include, but are not limited to, electrical stimulation, heat, cold or bruising. | **NO** |
| 2.7 | Does your research involve animals? | **NO** |
| 2.8 | Does your research involve the administration of drugs, placebos or other substances to study participants? | **NO** |
| **A.3 If you answer YES to any of the questions in this block, then unless you are applying to an external ethics committee or the SREC, you must apply for approval from the Computer Science Research Ethics Committee (CSREC) through Research Ethics Online - https://ethics.city.ac.uk/**  **Depending on the level of risk associated with your application, it may be referred to the Senate Research Ethics Committee.** | | *Delete as appropriate* |
| 3.1 | Does your research involve participants who are under the age of 18? | **NO** |
| 3.2 | Does your research involve adults who are vulnerable because of their social, psychological or medical circumstances (vulnerable adults)?  This includes adults with cognitive and / or learning disabilities, adults with physical disabilities and older people. | **NO** |
| 3.3 | Are participants recruited because they are staff or students of City, University of London?  For example, students studying on a particular course or module.  If yes, then approval is also required from the Head of Department or Programme Director. | **NO** |
| 3.4 | Does your research involve intentional deception of participants? | **NO** |
| 3.5 | Does your research involve participants taking part without their informed consent? | **NO** |
| 3.5 | Is the risk posed to participants greater than that in normal working life? | **NO** |
| 3.7 | Is the risk posed to you, the researcher(s), greater than that in normal working life? | **NO** |
| **A.4 If you answer YES to the following question and your answers to all other questions in sections A1, A2 and A3 are NO, then your project is deemed to be of MINIMAL RISK.**  **If this is the case, then you can apply for approval through your supervisor under PROPORTIONATE REVIEW. You do so by completing PART B of this form.**  **If you have answered NO to all questions on this form, then your project does not require ethical approval. You should submit and retain this form as evidence of this.** | | *Delete as appropriate* |
| 4 | Does your project involve human participants or their identifiable personal data?  *For example, as interviewees, respondents to a survey or participants in testing.* | **YES** |

**PART B: Ethics Proportionate Review Form**

If you answered YES to question 4 and NO to all other questions in sections A1, A2 and A3 in PART A of this form, then you may use PART B of this form to submit an application for a proportionate ethics review of your project. Your project supervisor has delegated authority to review and approve this application under proportionate review. You must receive final approval from your supervisor in writing before beginning the planned research.

However, if you cannot provide all the required attachments (see B.3) with your project proposal (e.g. because you have not yet written the consent forms, interview schedules etc), the approval from your supervisor will be ***provisional***. You **must** submit the missing items to your supervisor for approval prior to commencing these parts of your project. Once again, you must receive written confirmation from your supervisor that any provisional approval has been superseded by with ***full approval*** of the planned activity as detailed in the full documents. **Failure to follow this procedure and demonstrate that final approval has been achieved may result in you failing the project module.**

Your supervisor may ask you to submit a full ethics application through Research Ethics Online, for instance if they are unable to approve your application, if the level of risks associated with your project change, or if you need an approval letter from the CSREC for an external organisation.

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| **B.1 The following questions must be answered fully.**  **All grey instructions must be removed.** | | *Delete as appropriate* |
| 1.1. | Will you ensure that participants taking part in your project are fully informed about the purpose of the research? | **YES** |
| 1.2 | Will you ensure that participants taking part in your project are fully informed about the procedures affecting them or affecting any information collected about them, including information about how the data will be used, to whom it will be disclosed, and how long it will be kept? | **YES** |
| 1.3 | When people agree to participate in your project, will it be made clear to them that they may withdraw (i.e. not participate) at any time without any penalty? | **YES** |
| 1.4 | Will consent be obtained from the participants in your project?  Consent from participants will be necessary if you plan to involve them in your project or if you plan to use identifiable personal data from existing records. “Identifiable personal data” means data relating to a living person who might be identifiable if the record includes their name, username, student id, DNA, fingerprint, address, etc.  *If YES, you must attach drafts of the participant information sheet(s) and consent form(s) that you will use in section B.3 or, in the case of an existing dataset, provide details of how consent has been obtained.*  *You must also retain the completed forms for subsequent inspection. Failure to provide the completed consent request forms will result in withdrawal of any earlier ethical approval of your project.* | **YES** |
| 1.5 | Have you made arrangements to ensure that material and/or private information obtained from or about the participating individuals will remain confidential? | **NO** |

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| **B.2 If the answer to the following question (B2) is YES, you must provide details** | | *Delete as appropriate* |
| 2 | Will the research be conducted in the participant’s home or other non-University location?  *If* ***YES****, you must provide details of how your safety will be ensured.*  *Will be an online game demo that will be sent out* | **YES** |

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| **B.3 Attachments**  **ALL of the following documents MUST be provided to supervisors if applicable.**  **All must be considered prior to final approval by supervisors.**  **A written record of final approval must be provided and retained.** | ***YES*** | ***NO*** | ***Not Applicable*** |
| Details on how safety will be assured in any non-University location, including risk assessment if required (see B2) |  |  |  |
| Details of arrangements to ensure that material and/or private information obtained from or about the participating individuals will remain confidential (see B1.5)  *Any personal data must be acquired, stored and made accessible*  *in ways that are GDPR compliant.* |  |  |  |
| Full protocol for any workshops or interviews\*\* |  |  |  |
| Participant information sheet(s)\*\* |  |  |  |
| Consent form(s)\*\* |  |  |  |
| Questionnaire(s)\*\*  *sharing a Qualtrics survey with your supervisor is recommended.* |  |  |  |
| Topic guide(s) for interviews and focus groups\*\* |  |  |  |
| Permission from external organisations or Head of Department\*\*  *e.g. for recruitment of participants* |  |  |  |

*\*\*If these items are not available at the time of submitting your project proposal, then* ***provisional approval*** *can still be given, under the condition that you must submit the final versions of all items to your supervisor for approval at a later date.* ***All*** *such items* ***must*** *be seen and approved by your supervisor before the activity for which they are needed begins. Written evidence of* ***final approval*** *of your planned activity must be acquired from your supervisor before you commence.*

**Changes**

If your plans change and any aspects of your research that are documented in the approval process change as a consequence, then any approval acquired is invalid. If issues addressed in Part A (the checklist) are affected, then you must complete the approval process again and establish the kind of approval that is required. If issues addressed in Part B are affected, then you must forward updated documentation to your supervisor and have received written confirmation of approval of the revised activity before proceeding.

**Templates for Consent and Information**

You must use the templates provided by the University as the basis for your participant information sheets and consent forms. You **must** adapt them according to the needs of your project before you submit them for consideration.

Participant Information Sheets, Consent Forms and Protocols must be consistent. Please ensure that this is the case prior to seeking approval. Failure to do so will slow down the approval process.

We strongly recommend using Qualtrics to produce digital information sheets and consent forms.

**Further Information**

<http://www.city.ac.uk/department-computer-science/research-ethics>

https://www.city.ac.uk/research/ethics/how-to-apply/participant-recruitment

https://www.city.ac.uk/research/ethics