Simulating human civilisation and the evolution of society based on factors such as culture, religion, and technology – Project plan

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Table of Contents

[1 Introduction 1](#_Toc85808208)

[2 Aims and Objectives 2](#_Toc85808209)

[3 Risk Evaluation 4](#_Toc85808210)

[4 Time Management 4](#_Toc85808211)

1. Introduction

History is a divisive subject, and rightfully so. Stories from centuries past still define the day-to-day life of people across the world – simple lines drawn by forgotten men have resulted in chaos and oppression, while some small mistakes have resulted in prosperity for millions. Any discussion of this topic will inevitably end in disagreement, regardless of opinion though, it is undeniable the impact some people have had on the world. It is quite interesting then, how these actions that have changed the lives of countless people, are so easily represented on a simple piece of paper – conflicts of family, money or faith reduced to simple points on a map.

But it cannot be forgotten that these factors are what defines a map. Each curve on a page is a representation of all the preceding events in time, from the mightiest king’s conquests down to the lowliest peasant’s construction of a shelter for the night. This is likely the reason why most fictional maps often seem unrealistic when compared to real historical records, often seeking simply to split a world into factions rather than create a breathing world moulded by its history. This is an issue that is prevalent in almost all media that seeks to portray a fictional world, stemming from attempting to design a world as it exists at the time of a story, rather than from where it began. A truly believable map must represent the decisions of all the people who came before it, and therefore to make a world, you must start from the beginning.

This philosophy is what inspired this project, a map simulation. Starting from the dawn of civilisation on a fictional world map, a user will be able to see time pass – nations developing, changing, and falling, all as a result of how the people of these nations see the world around them, and what factors influence their actions. When the user pauses the simulation, they should see a map truly defined by its history.

This project could see uses in multiple different fields – primarily in the video game industry. The game development industry is currently leaning towards a theme of procedural generation – and so this project could be put to use in developing a populated world map for use within a game, especially for titles in the strategy, roleplaying or roguelike genres. Additionally, the results of the simulation could see use as a reference tool for video game development – rather than being an implemented algorithm in a system, the project could be used to generate a map to be built upon by designers in order to create non-procedural content.

If the project is particularly successful, it could see use as an educational tool which, while not portraying real history, could demonstrate what factors have had an impact on our world’s history. This is an especially important concept for the modern day as history education is often just explored as simply a checklist of events and what directly caused these events. Considering the more hidden factors that lead to key points in history is a necessary topic for fully understanding the gravity and reason for conflicts in history – such as how the mountains of Afghanistan have aided its survival against foreign powers or how the shortage of domestic animals in the Americas lead to the plagues which weakened the native’s ability to fight against the colonial powers.

This concept has been done in some capacity in the past – as previously mentioned, the game development industry is heavily focusing on procedurally-generated content currently, and so inevitably some programs and algorithms exist with parallels to this system. But the intention of this project is to create something unique in its realism, many examples of implementations of this are designed around usage in a particular system and therefore have creative liberties included that this project will steer away from.

1. Aims and Objectives

To expand on the concept discussed above, the specific aim of this project is to develop a simulation of a world map that portrays the birth, expansion, and recession of nations over time. Starting from an empty map, over time the simulation will develop a populated world map which has been defined by socio-economic factors such as culture, access to resources and faith as well as ideas like international relations, technology, and geography. All of this will serve as evidence towards the hypothesis behind this endeavour – “*Can a simulation be used to believably portray a new world history, using artificial representations of factors that have defined real history, and what algorithms can and should be used to achieve this objective?”*.

The artefact produced as a result of this project will be heavily documented; presenting algorithms used, comparisons to existing projects (Including a previous attempt at a concept similar to this, which will be referred to extensively as a comparative resource) as well as extensive logs of testing whenever a key point in development is reached. At the end of the development cycle, records of the accuracy of the program will be produced, demonstrating instances where the model has particularly shown evidence to support the proposed hypothesis, as well as incidents where it has failed to meet the goals specified.

In terms of objectives for the project, this software must exhibit the following features in order to be deemed successful:

* Permit the generation of a unique terrain map. This would serve as the backdrop for the simulated history. This map must be randomly generated, with each new simulated world having their own map to act upon. This map must exhibit the following features:
  + Height mapping
  + Land and sea generation based on surface heights
  + Temperature
    - A defined polar region at the north or south of the map
    - An equator which defines the temperate regions of the map
  + Rivers and mountains using surface heights as a guideline
  + Biomes using the temperature, proximity to water and height of a location as well as additional Perlin noise masks to decide aspects like forest density
  + Resource distribution
* Populate this map with preliminary factors which define the nature of the world at the start, essentially simulating pre-history. The model will start by dividing the map into various regions, using the geography of the map to define the density of peoples – for example low flora locations with a consistent height mapping and extreme temperatures will often have a dispersed populace, and will therefore be represented by a larger region. These regions will then be provided the following factors:
  + Vertices
  + Colour (referring to the colour a nation will be represented as if this region becomes a capital)
  + Name of the provincial capital
  + Population (This factor will be independent of the previously defined population density though will use geographical information once again)
  + Culture (A shared property between a random number of connected provinces)
  + Cultural region (A constant property that is shared between many provinces, in a similar geographical region. All provinces in the same culture will be in the same cultural region, and this variable will act loosely like continents in real life)
* Simulate time on the map, starting from the empty map previously generated. A year, month and date will be presented to the user, starting at January 1st of the 0th year. On user request, the simulation can be started or stopped, with time progressing on a set interval when the simulation is in the “started” state. In this active state, the people of the world should be able to take actions depending on their surroundings – the following actions and features must be included as a part of this procedure:
  + Ability for nations to form – while all land in the simulation is populated, a region must enter a centralised state to be considered a “nation”.
  + Ability for nations to declare war on others and take land, either from other nations or from non-centralised regions.
  + Permit the development of technology which provides a nation advantages over less advanced states.
  + Allow nations to create and or adopt national religions
  + Allow nations to split due to internal pressure or revolts.
* Develop an artificial intelligence system that determines what actions a nation will take in a specific moment. This will permit the aforementioned actions to occur – as each nation will now have the ability to decide what to do based on the world around it, allowing for an ever-changing world. The following factors will influence the decisions made by a nation:
  + Culture – a nation will first and foremost seek to take lands that have the same culture as them
  + Military and technological strength – nations will act more defensively when presented with a target that is stronger than them
  + Climate and geography – nations will often focus on taking lands that are more hospitable and will be dissuaded from attacking nations with terrain advantages, such as mountains and rivers.
  + Opinion – each nation will have an opinion of other nations, influenced by past actions such as wars as well as any similarities shared by the nations (for example, nations will have a better opinion of those with the same religion as them).
  + Personality – rulers of nations will have their own personalities which influence their decisions greatly. These will impact the likelihood of each action to occur, as well as how much opinion is modified by properties such as religion or technology. This will allow the nations to make mistakes in their judgements, rather than just using algorithms to calculate the best course of action at all times. Leader traits will change over a period of years, as new rulers come to power.

Each of these objectives will be measured by the inclusion of the features listed in their respective descriptions – in the documentation evidence will be provided in order to show that the software has implemented each of the specified functions. Due to the nature of the hypothesis, it is impossible to measure exactly how successful the artefact has performed in creating the aforementioned “believable world”; therefore, this document will define the following characteristics as a measure of the success of the results of the project against the hypothesis:

* Chronological accuracy. The results of the system should provide parallels against key eras of real history. Evidence will be provided of a single instance of the simulation demonstrating two or more of the following eras of history:
  + Dawn of civilisation - A number of large powers form while the majority of the world remains in a tribal or dispersed state
  + Bronze age collapse - Through any means, at least one large power should be overtaken or splinter into different states
  + Classical age – Small states, either remnants of a former great power or newly formed, should become more common, and should seek to unify provinces of their cultural groups.
  + Medieval period – Many cultures should be entirely owned by a nation representing their culture; wars should be frequent between states.
  + Renaissance – A large technology gap should form between different regions on the map. The majority of the map should now have nations on it. States with better technology than others may begin to subjugate others
  + Modernisation – The technology gap should begin to even out between nations. All land should eventually become occupied
* Impact of the world. The intention of the system is to show how different factors effect the shape of the world around us, and therefore it is important to demonstrate instances in which these factors are relevant. The documentation will provide examples of decisions made based on the following factors:
  + Culture
  + Religion
  + Technology
  + Geography
* Believability. The decisions made over the course of the system should demonstrate believably human qualities. Some examples of the following will be provided in the documentation:
  + Mistakes – in which a nation is shown to have made a decision that has negatively impacted their situation.
  + Collapse – in which a nation is subjected to many negative events (such as war or revolt) in a short period of time – almost as if the people have recognised the weakness of the regime and have taken advantage of this state.
  + Rivalry – in which two or more nations are shown to consistently have low relations with one-another, and conflicts are frequent between the two subjects.

1. Risk Evaluation

The biggest risk to this project is its scope – the concept as outlined in this document is extensive and ambitious, meaning it will require a significant time investment in order to achieve its objectives. This leaves the risk that the project will not get completed in the necessary time frame, or that critical components of the system will be rushed in order to meet deadlines. This problem will be mediated by the inclusion of a Gantt chart and development cycle, as discussed in the time management segment of this document.

Another aspect that could harm the development of this system is the variety of topics the project proposal encompasses. To successfully meet the objectives as listed in this document, research will need to be completed into the fields of artificial intelligence, random generation, and modelling. Additionally, for the sake of documentation, some research into historical records will need to be completed. While the majority of this material will be covered in the initial literature review, it will be necessary to complete research throughout the development cycle – this will take the form of references in the documentation of the procedure.

Finally, the time scale and modular approach to the development of this system may cause issues, specifically in reference to code quality and retention. Over the course of the year-long cycle of development, there is likely to be changes to the coding style of the project – this could result in changes in efficiency or quality between different areas of the system, or potentially issues with integration of the two major implementations (world generation and simulation). Additionally, the timespan may also cause a lack of familiarity with previously developed aspects of the software – if changes need to be made to the world generation algorithm during simulation, it is likely that time will need to spent re-understanding the functionalities implemented months prior. This potential issue is why the development cycle will take a structured approach to implementation – with the intention that all necessary features of a development stage should be clarified in the design document, with the hope that if all the functions of a specific area of the system can be developed and tested within one stage, there will be no need to refer back to the previously written code.

1. Time Management

The development cycle of this project will consist of the following stages:

* Analysis – In which a literary review will be conducted on similar projects and relevant algorithms to determine the advantages and disadvantages of various approaches to this topic.
* Design – An extension of the literary review in which the results of the previous investigation will be applied to the context of the project – for example, an algorithm from a discussion on map generation will be selected for use within the project based on the merits presented within the literary review. This segment will also produce various designs for parts of the system, including user interface sketches as well as drafts of how components of the system will interact.
* World generation implementation – All aspects relevant to the pre-history world generation procedure will be produced in this stage, including the map generation and the preliminary factors discussed in the objectives segment.
* World generation review – A documented review of the results of the world generation procedure will be produced, including test logs and comparisons to relevant objectives and similar projects. Adjustments to the implementation will be made if necessary.
* Simulation implementation – The time progression and artificial intelligence procedures will be implemented, allowing the simulation to develop a world over time
* Simulation review – Similar to the previous review segment, the implemented functionalities will be tested, compared, and analysed.
* Overall testing – This segment will produce the main body of the test log, producing documentation of testing into all the major functionalities of the software – including acceptance, edge case and erroneous testing procedures where applicable.
* Hypothesis review – This stage will consist of returning to the objectives and hypothesis outlined in this document and detailing how the project met the outlined goals, and to what extent the hypothesis is proven or disproven by the results produced.

The provided Gantt chart details how these stages will be completed, as well as the timeframe in which the objectives will be met during development.

