USER MANUAL

Agent Based Model for simulating ancient Egypt

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USER'S MANUAL

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A. GENERAL INFORMATION

1.1 SYSTEM OVERVIEW

A graphical user interface which allows the user to simulate different conditions during predynastic Egypt, it visually displays relevant information in graphs and shows a visual representation of how settlements move.

1.2 SYSTEM CONFIGURATION

This is a Python 3 based application which relies on Mesa; a python framework for agent-based modelling. I also makes use of python libraries such as NumPy and Matplotlib. The user adjusts the sliders or checkboxes in order to change the values of variables in the model. They are then able to run the simulation and collect data on the values they have set. This allows graphical representations to be easily created in order to be used for comparisons of how different variables affect the model and the effect of this on the simulation of predynastic Egypt.

B. GETTING STARTED

2.1 INSTALLATION

2.1.1 QUICK START

```
python3 run_simulation.py [grid_width] [grid_height]
```

2.2.1 GENERAL USAGE

INSTALL REQUIREMENTS:

```
pip3 install -r requirements.txt
```

APPEND SRC DIRECTORY TO PYTHONPATH

```
export PYTHONPATH=$PYTHONPATH:`pwd`:`pwd`/src
```

RUN SIMULATION IN TERMINAL

```
python3 src/simulations/gui_simulation.py [grid_width] [grid_height]
```

Example:

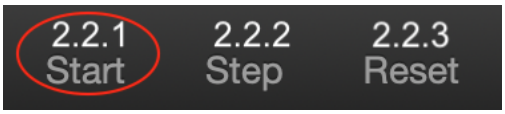
```
python3 src/simulations/gui_simulation.py 31 30
```

2.2 USER INTERFACE MENU

Running the simulation opens up a web page of the agent-based Egypt model.

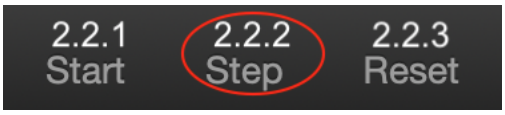
2.2.1 START

This button starts the agent-based model using the default variable values, it will run until stopped using the Stop button.



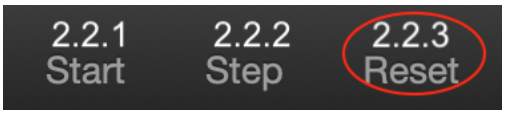
2.2.2 STEP

This button moves the agent-based model forward by one year manually.



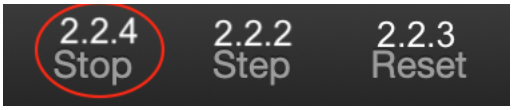
2.2.3 Reset

This button sets model variables to the current user interface parameter state.



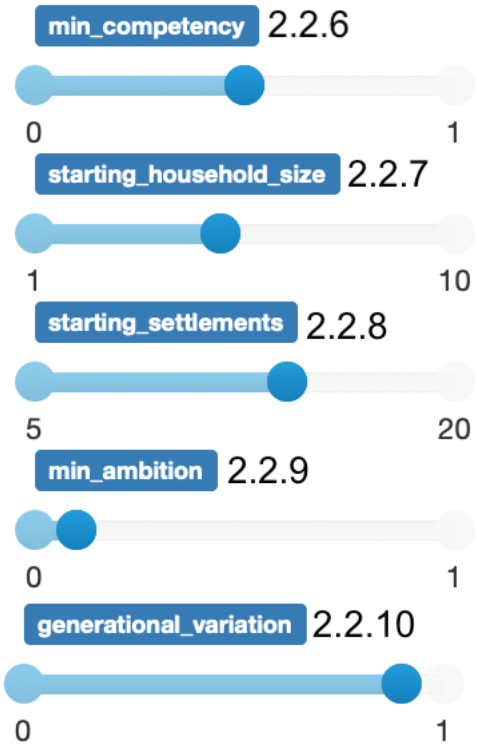
2.2.4 Stop

This button stops the agent-based model, will remain stopped unless the Start button is clicked again.



2.2.5 Frames per second

This slider can be set by the user between the values of 0 and 20, it is responsible for the speed at which the model runs.



2.2.6 Min Competency

This slider can be set by the user between 0 and 1, it represents the competency of an agent as a percentage.

2.2.7 Starting Household Size

This slider can be set by the user between 1 and 10, it represents the how many agents belong to a household.

2.2.8 Starting Settlements

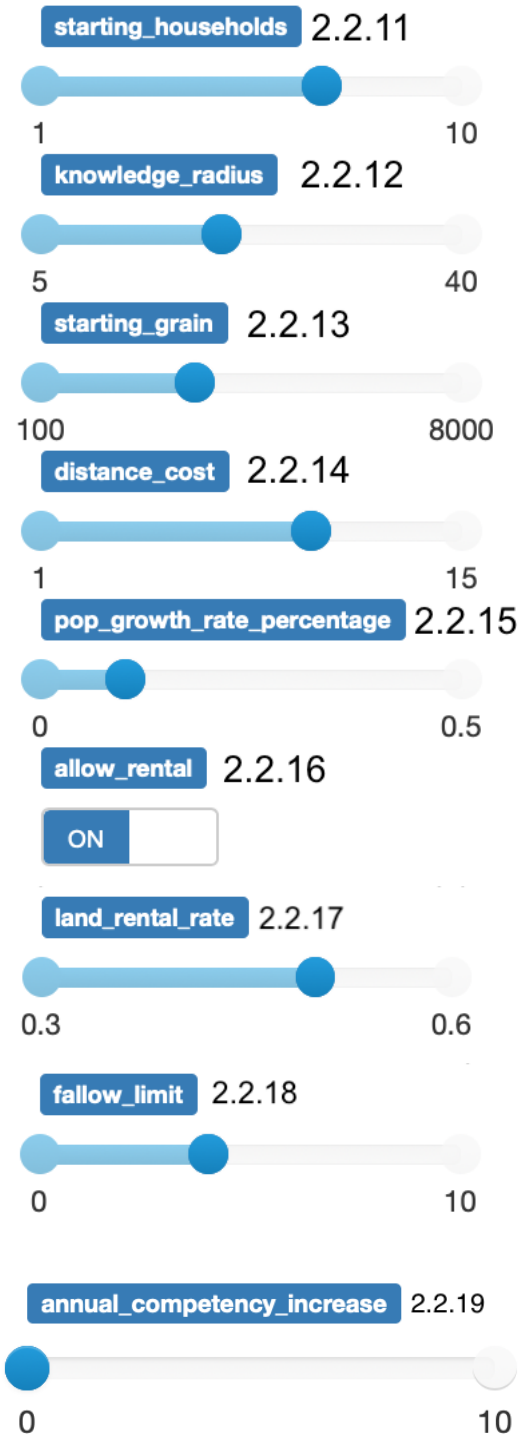
This slider can be set by the user between 5 and 20, it represents how many settlements are initially created.

2.2.9 Min ambition

This slider can be set by the user between 0 and 1, it represents the ambition of an agent as a percentage.

2.2.10 Generational Variation

This slider can be set by the user between 0 and 1, it represents the variation caused by changing agents in a household as a percentage.



2.2.11 Starting Households

This slider can be set by the user between 5 and 10, it represents the number of households that are a part of the settlements.

2.2.12 Knowledge Radius

This slider can be set by the user between 5 and 40, it represents the radius around settlements are aware of to claim fields.

2.2.13 Starting Grain

This slider can be set by the user between 100 and 8000, it represents the amount of grain each settlement starts with.

2.2.14 Distance Cost

This slider can be set by the user between 1 and 15, it represents the cost of distance covered.

2.2.15 Population Growth Rate Percentage

This slider can be set by the user between 0 and 0.5, it represents the rate at which the h/s grow.

2.2.16 Allow Rental

This checkbox can be set by the user to allow land rental (YES) or not allow land rental (NO).

2.2.17 Land Rental Rate

This slider can be set between 0.3 and 0.6, it represents the rate at which land can be rented as a percentage.

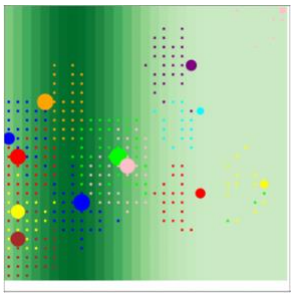
2.2.18 Fallow Limit

This slider can be set between 0 and 10, it represents the max amount of years a field can lay fallow before it can be claimed by other households.

2.2.19 Annual Competency Increase

This slider can be set between 0 and 10, it represents a yearly increase in the competency of a household.

2.3 VISUALISATION

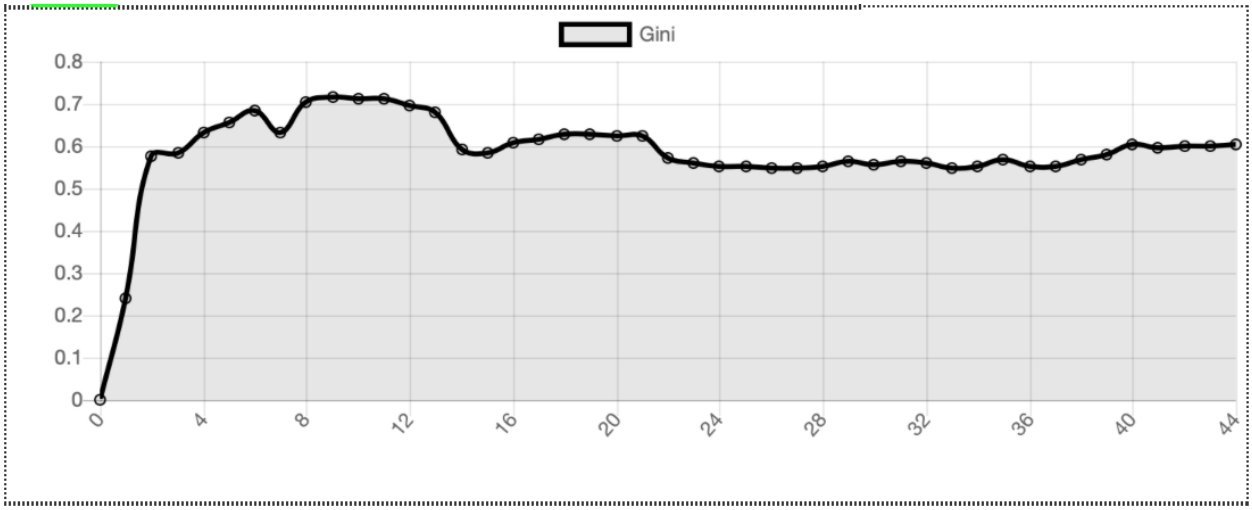


The different shades of green on the model show fertility; where darker green is higher fertility and lighter green is lower fertility. Settlements are depicted by circles and fields are depicted by squares. The colour of fields is the same colour as the settlement to which they belong.

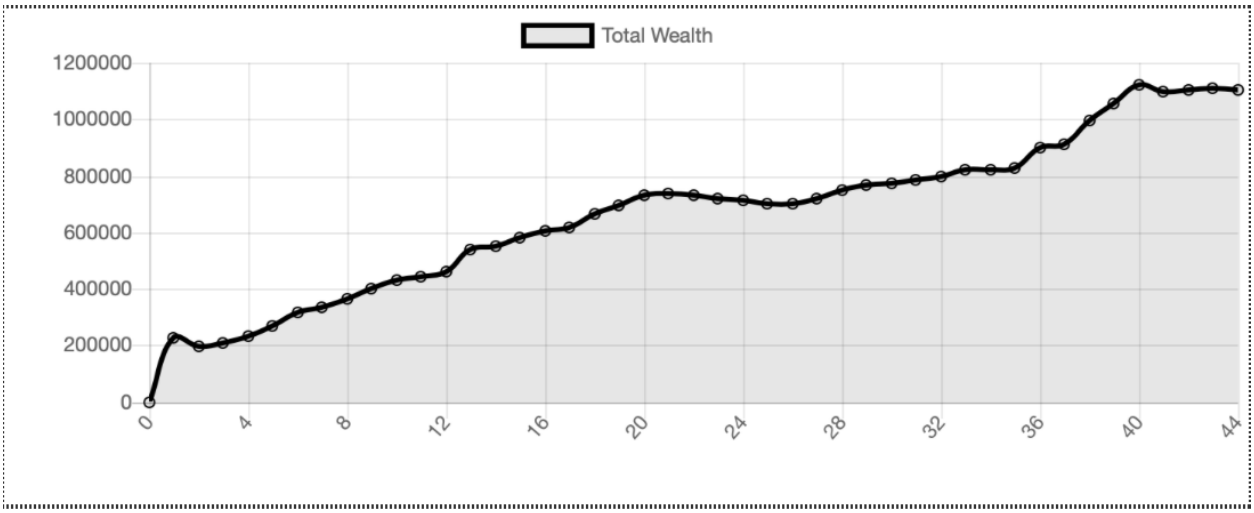
2.4 GRAPHS

Display useful information pertaining to data collected during the simulation such as Gini, Total Wealth, Mean Settlement Wealth, Total Population and Mean Settlement Population.

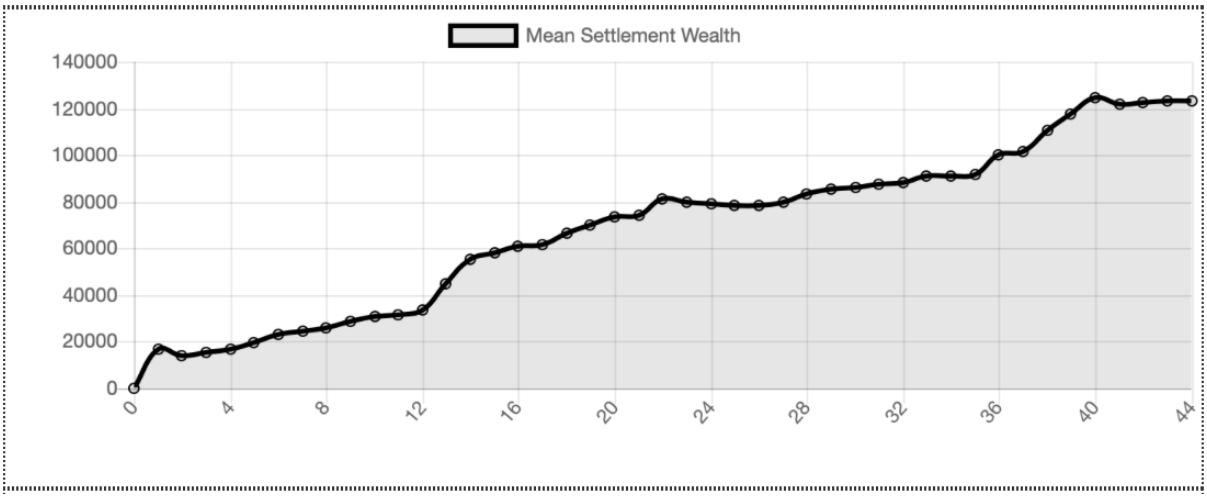
2.4.1 GINI



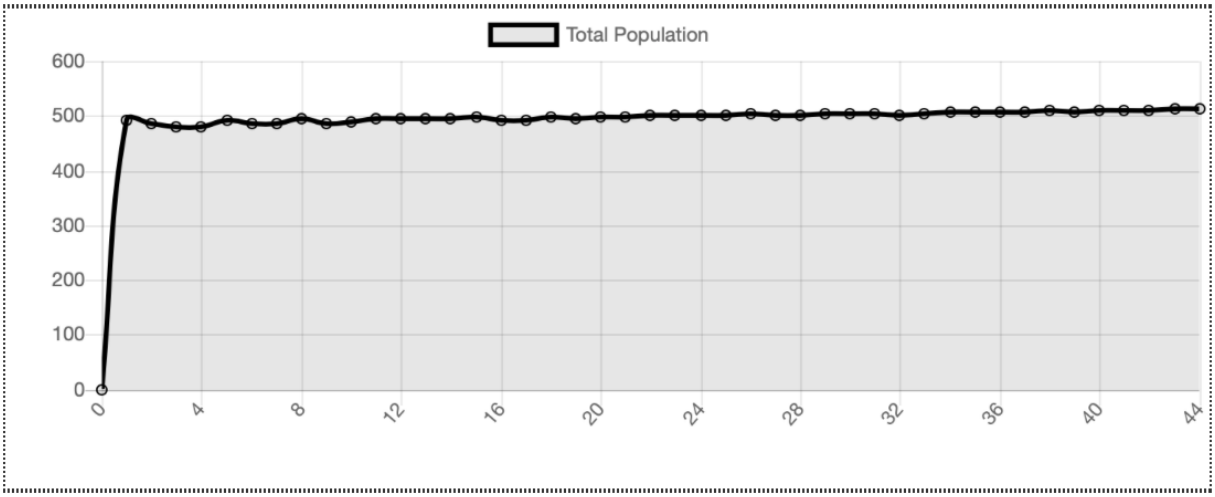
2.4.2 TOTAL WEALTH



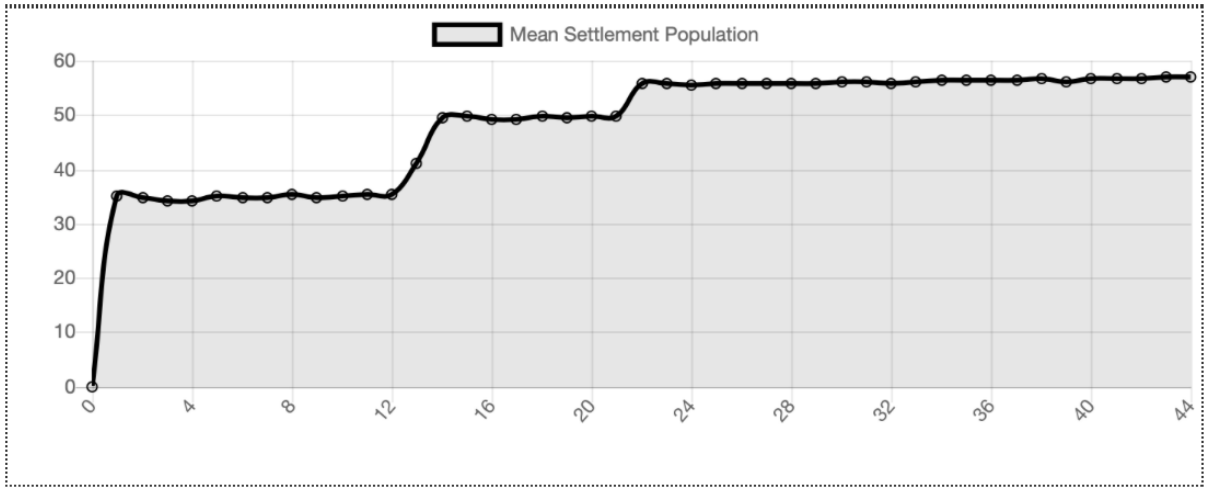
2.4.3 Mean Settlement Wealth



2.4.4 Total Population

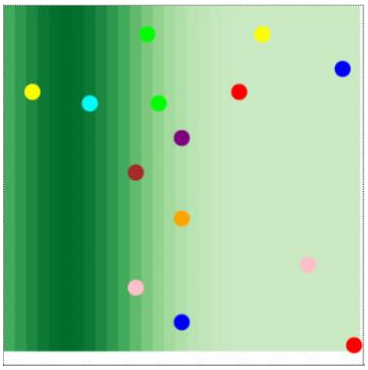


2.4.5 Mean Settlement Population

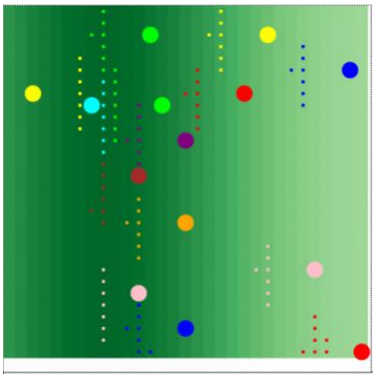


2.5 MODEL

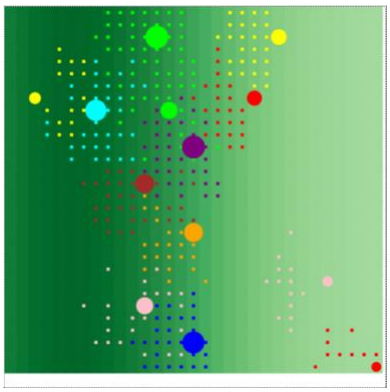
Model with default values at start:



Model after one step:



Model after ten steps:

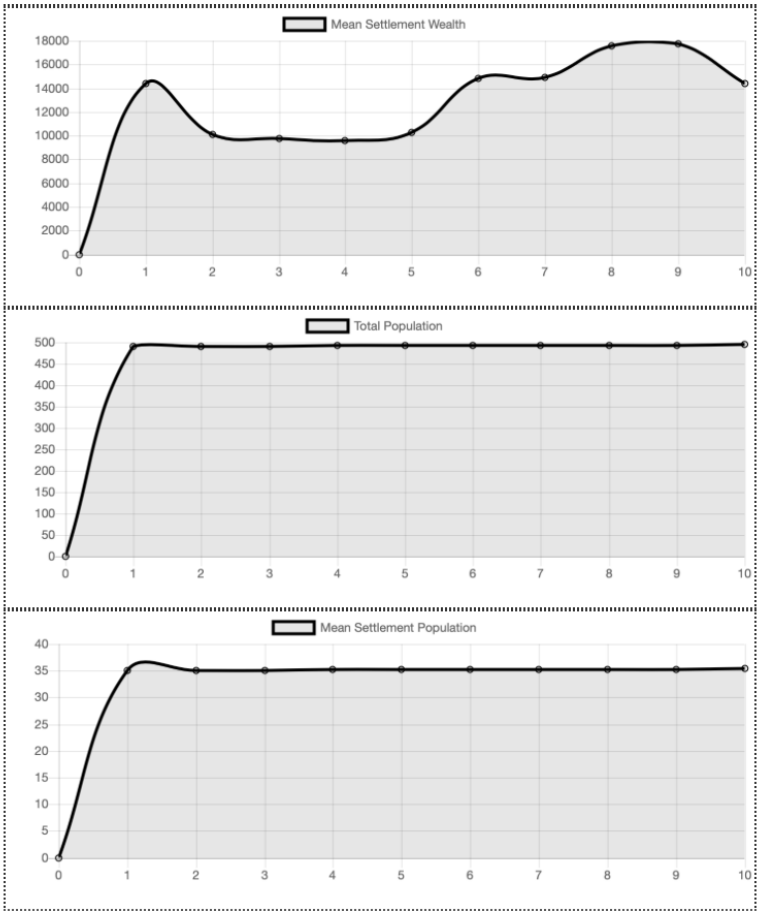


2.6 EXIT SYSTEM

Exit Window in browser.

A. APPENDIX

Full view of the agent-based model user interface:


Mean Settlement Wealth
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0 1 2 3 4 5 6 7 8 9 10
Total Population
500
450
400
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10
Mean Settlement Population
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10