War is barbarous and inhuman. Nothing is more cruel, nothing more tragic. . . .

How can we (A-Life researchers) contribute to achieve the eternal peace?

- Many efforts to keep peace have failed repeatedly in human history.

- An intuitive answer from Evolutionary Theory:
  It is insolvable since people who employ peaceful strategies always suffers the domination of an aggressive nation with strong military power.

- Our approach:
  Building a computational model of international relationship based on a multi-agent system to deepen our understanding *why wars continue arising*.
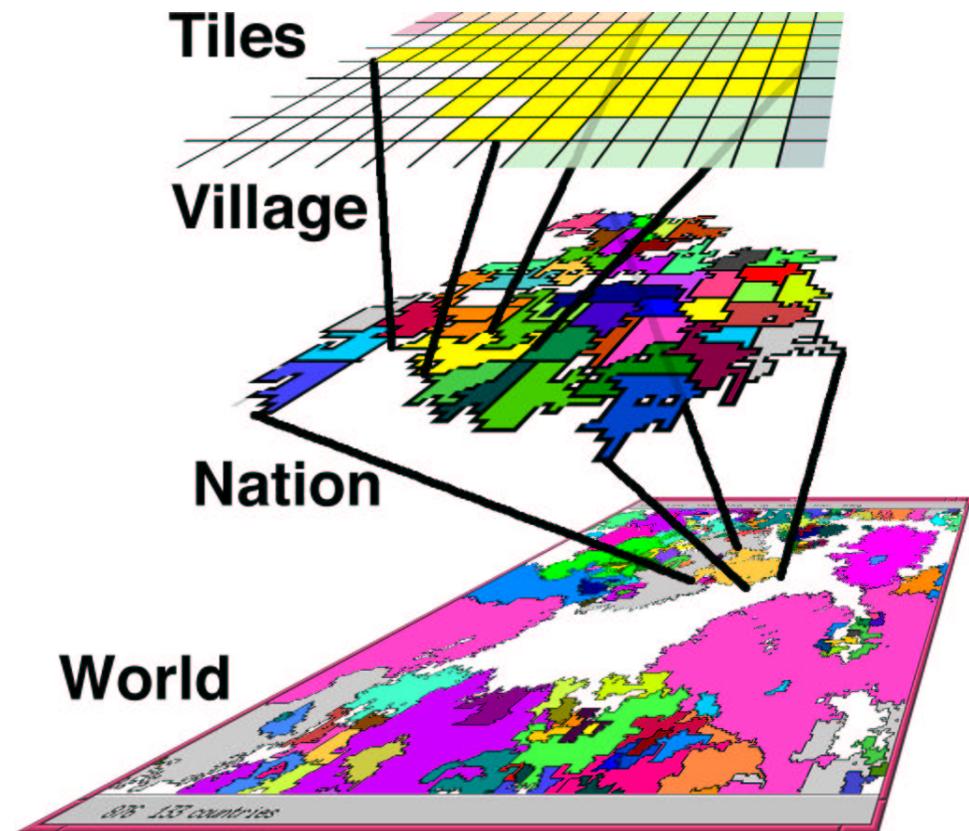
Simplified World Model

Land =

2D toridal grid world

256×256 tiles.

- Each *tile* grid is either occupied by a village or is empty.

- Each village occupies one or more adjoining tiles.

- Each nation consists of one or more adjoining villages.

- Villages and Nations are agents in different layers.

Villages

- People.
  Population increases by natural increasing rate,
  and decreases by war casualties and starvation.
  Each person works as a *farmer*, a *officer*, or a *soldier*.

- Food production, stock, decay and consumption.
  The harvest is limited by the number of farmers and the breadth of land, and is affected by random fluctuation.

- Development and split.
  If the number of farmers is large enough, then tries to develop one adjacent empty tile per one step.
  If the number of tiles > 50, then the village is split into two.

- Independence and move.
  Each village can select the belonging nation,
  comparing *richness* of alternative nations.
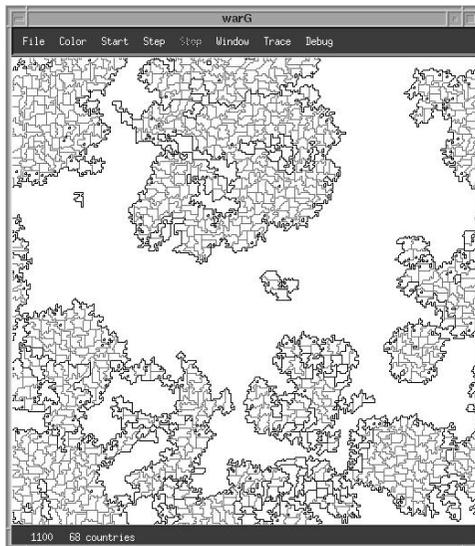
Nations

- Food redistribution.
  Redistribution of foods from rich villages to poor villages.

- Workers allocation.
  Each nation decides the proportion among three types of workers.
  (1) Farmers for food production,

  (2) Officers for public service, and

  (3) Soldiers for fight. (= military power)

- Invasion, defence, and occupation.
  Each nation probabilistically intends to occupy a rich village of weak nation beyond the border.
  The result is probabilistically determined from the ratio of military power between fighting nations.
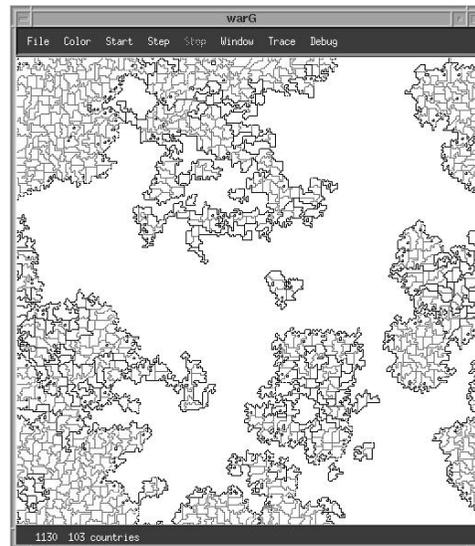
Evolution

- Meme = some parameters for decision making.

  Village: Percentage of maximum consumption from the food stock,
  Threshold value to try to develop a new tile, and
  Tendecy of independence and move.

  Nation: Parameter of foods redistribution,
  Parameters to decide the proportion of workers, and
  Aggressiveness.

- Genetic operation = mutation.
  Adding a random number within a predefined range to each gene.

- Selection by agent's extinction
  (1) A village ruins when all habitants were killed.

  (2) A nation ruins when it has no village.
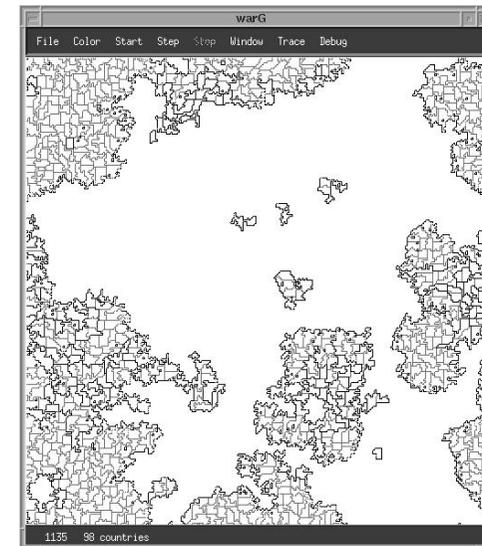
Scenario (1) − Rise, division, then ruin

- Occasional mistake because of mutation or neighbour nations' change.

→ Independence of relatively rich villages and/or fall of poor villages under starvation.

→ Separation into a number of smaller nations.

→ Invasion from adjacent big nation, or fall under starvation.
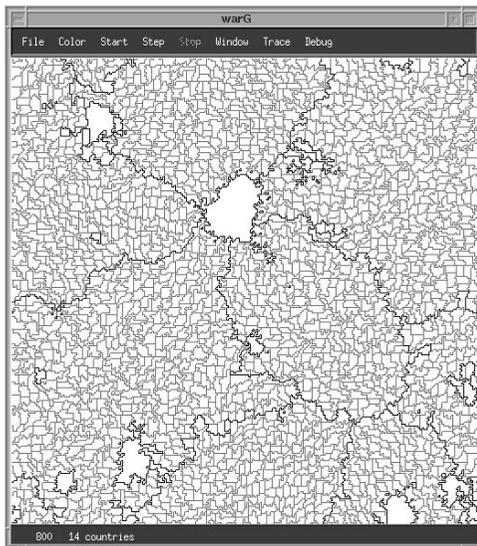
Step 1100   Step 1130   Step 1135
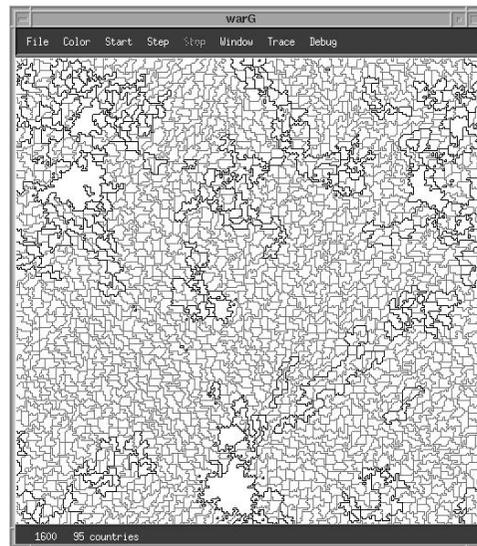
Scenario (2) − Equilibrium and domination

- With lower mutation rate.

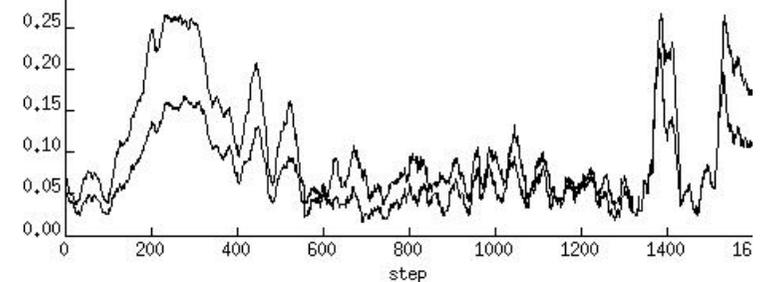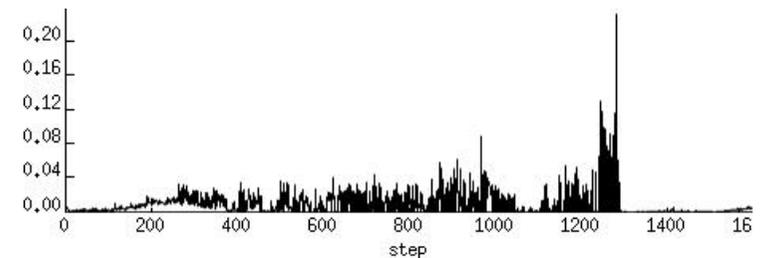- Equilibrium with a few large nations, then domination of one huge ruling nation.

Step 800

Step 1600

The times of wars per nation.

The proportion of war casualties.

Conclusion

- Possible extension:

  (1) Upper layer over nations: coalition or alliance among nations.

  (2) Lower layer under villages: psychological model of citizens.

  (3) Distribution of troops.

  (4) Nonuniform distribution of natural resources.

  (5) Race, religion, ideology, *et al.*

- We hope the usage of this particular system can contribute to realising a more peaceful world.

Contact info. :   Tatsuo Unemi (Prof.)
Department of Information Systems Science, Soka Univ.,
1-236 Tangi-machi, Hachiōji, Tokyo, 192-8577 Japan
unemi@iss.soka.ac.jp
http://www.intlab.soka.ac.jp/~unemi/