CulSim: Emergence and Resilience of Cultural Diversity in a Computer Simulator

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MOTIVATION

The existence of diverse cultural groups is paradoxical (e.g. [1]): we live in an interconnected world where individuals constantly share information with each other, and yet, diversity remains. Diversity persists despite events that can occur in real life, including those in online social networks. These events can be, for example, institutional collapses, invasions, and mergers of social platforms, server crashes or user trolling.

CulSim allows the exploration of emergence and resilience of cultural groups when they are faced with such events. Additionally, the combination of events allows researchers to approximate more realistic scenarios. One of several computer models [2,3,4] can be chosen as a basis for such explorations.

CULSIM

- 4 models: Axelrod [2], multilateral social influence [3], multilateral social influence and homophily [3], institutional [4]
- 11 parameters: grid size, neighbourhood radius, number of features and traits, perturbations (mutation and selection error) institutional parameters (influence, loyalty, democracy, propaganda)
- 7 events: decimation, apostasy, settlement, immigration, institutional destruction, institutional content removal, and institutional conversion
- 6 configurable event distributions, e.g. normal and uniform
- 20 response variables on display (e.g. similarity measurements, cultural diversity, energy, number of institutions, foreigners), and additional ones in the output files
- Graphical user interface which allows visual exploration of singular scenarios, or simple experimental designs
- A command-line interface to configure comprehensive experimental designs on computer servers

INSTITUTIONAL MODEL

CulSim [5] includes my recently proposed model [4] (Fig. 1), which introduced institutions in order to:

- Increase the robustness of the emergence of cultural diversity against mutations [6] and selection error [3]
- Explore effects of institutional influence and institutional mechanisms such as propaganda or democracy
- Analyze event that target institutions

RESULTS

Fig. 2 illustrates a comparison of two events: (1) Decimation: all cultural traits from a set of agents are removed, and (2) Settlement: all traits from a set of agents are replaced with foreigner traits. The set of agents is selected using a 2D normal probability distribution function (std = 0.2) with its maximum value (1.0) at the center of the grid. The state just before the event is produced after 1000000 iterations (agents’ cultural vectors where randomly initialized) using the institutional model [4] with the following fixed parameters: institutional influence of 0.65, grid size of 50x50, 6 cultural features, 14 cultural traits, Von Neumann neighborhood of radius 3, mutation and selection error with probability 0.001, agent loyalty of 0.5, and no propaganda or democracy.

Fig. 3. shows the results for seven events in two versions of two scenarios: (1) many cultures, agents’ cultural vectors where randomly initialized, and cultures emerged after 100000 iterations; (2) one culture, all agents contain the same cultural traits and belong to the same institution. The simulation was run using the institutional model [4] with the following fixed parameters: 5 cultural features, 15 cultural traits, mutation and selection error with probability 0.001, agent loyalty of 0.5, and no propaganda or democracy. Grid size, neighborhood, and institutional influence where varied according to the legend of the figure.

DISCUSSION AND FUTURE DIRECTIONS

Cultural diversity is suggested as a mechanism of resilience. Future work will focus on analyzing the interaction between diversity and the number of institutions in terms of resilience. CulSim has recently been used to explore case studies about the Maya: Collapse, Spanish Invasion and Civil War (1980), illustrating its applicability to real life scenarios and across different disciplines.

The ideas presented here, in particular institutional factors, can be explored with dynamic social networks. This might help us to better understand how polarization, such as the one we observe in current world political affairs, occurs in spite of increased communication everywhere.