Micro-cleavages and Violence in Civil Wars: A Computational Assessment

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Appendix: Formal Description of the Model

The model features a population of agents $A_i, i \in \{1..N\}$. Each agent i has

- a "culture" string $C_i \in \{0,1\}^D$ of length D
- an importance distribution I_i over the D dimensions such that $\sum_{d=1}^{D} I_{i,d} = 1$
- a resource level $R_i, R_i > 0$.

Agents are connected by a small-world network, following the algorithm described in Watts and Strogatz (1998). A small-world network has two parameters: the connection radius, and the rewire probability. The network creation works as follows: (i) agents are aligned in a ring; (ii) additional connections are introduced such that agents are also connected to the second-, third-, forth etc neighbors on both sides, up until the specified radius; (iii) each connection in the network is rewired with a certain probability u. As described above, u is referred to as urbanization parameter.

At every time step, N randomly selected network links are activated. Once a link between two agents i and j is activated,

1. the string Δ of cultural differences is computed as $|C_i - C_j|$
2. the conflict motivation m is computed as $\sum_{d=1}^{D} \Delta_d * I_{i,d} * I_{j,d}$
3. the conflict opportunity o is computed as $1 - \frac{R_{min}}{R_{min}+R_{max}}$, where R_{min} is the resource level of the weaker agent
4. conflict occurs with probability $m * o$.

If conflict occurs,

1. each agent's resources decrease by a proportion of the opponent's strength
2. an agent that has no resources left is eliminated from the simulation and replaced by a newly created one at the some network position
3. all network neighbors k of i and j adjust their importance distributions as

$$I_{k,d}^{new} = 0.5 * \delta_d + 0.5 * I_{k,d}^{old}$$

where δ is the normalized cultural differences vector Δ, and τ is the "impact of experience" parameter.

At the end of each time step, agents' resources are increased by 1 (or conditional on the alliance mechanism, see text).