

civilization_unbinding_simulation.py

text

```
import mesa
import pandas as pd
import numpy as np

class CivilizationAgent(mesa.Agent):
    def __init__(self, unique_id, model, initial_unbinding_level):
        super().__init__(unique_id, model)
        self.unbinding_level = initial_unbinding_level
        self.social_threshold = np.random.normal(0.7, 0.15)

    def step(self):
        if self.unbinding_level >= self.social_threshold:
            self.unbinding_level += 0.08 * self.model.global_tec
        else:
            self.unbinding_level += 0.012 * self.model.global_te

class CivilizationModel(mesa.Model):
    def __init__(self, num_agents=200, tech_multiplier=1.02):
        self.num_agents = num_agents
        self.global_tech_multiplier = tech_multiplier
        self.schedule = mesa.time.RandomActivation(self)
        for i in range(self.num_agents):
            agent = CivilizationAgent(i, self, np.random.uniform(
                0.5, 1.0))
            self.schedule.add(agent)

    def step(self):
        self.schedule.step()

    def run_simulation(self, steps=500):
        results = []
        for t in range(steps):
            self.step()
            avg_unbinding = np.mean([a.unbinding_level for a in
                self.schedule.agents])
            results.append({"timestep": t, "avg_unbinding_index":
                avg_unbinding})
        return pd.DataFrame(results)
```

