Envy-induced collective strategy condensation



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results preview ____

envy impacts societal structures



games with psychological components

Capraro & Perc, "Mathematical foundations of moral preferences" (2021).

(only) relative success matters _



envy

"the desire to compare oneself to others"

Sen. "Poor, relatively speaking" '83 McBride, "Relative-income effects on subjective well-being in the cross-section" (2001). Hopkins & Kornienko, "Running to keep in the same place: Consumer choice as.." (2004).

comparing monetary incomes_

average utility \equiv income





• population mean \overline{I}

"happy" $I^{\alpha} > \overline{I}$

enforce current strategy

"unhappy" $I^{\alpha} < \overline{I}$

try something else

▷ envy impacts individual strategies

choice & competition.

 p_i^{α} $p_i^{\alpha} \ge 0, \quad \sum_i p_i^{\alpha} = 1$ strategy probability that agent α selects option payoffs v(q_i) $v(q_i)$ utility function monetary utility $(1-\kappa)v(q_i)$ $I_i^{\alpha} = v(q_i) \left(1 - \kappa \sum_{\beta \neq \alpha} p_i^{\beta} \right)$ options q_i

 $v_i = v(q_i)$: what the agent receives when alone

K : penalty when two agents want the same

income & envy_

reward = income + psychology $R_i^{\alpha} = I_i^{\alpha} + \epsilon p_i^{\alpha} \log(I^{\alpha}/\overline{I})$

$$I^{\alpha} = \sum_{i} I^{\alpha}_{i} p^{\alpha}_{i}$$

- ϵ : strength of envy
- $I^{\alpha} > \overline{I}$: keep current strategy
- $I^{\alpha} < \overline{I}$: search for alternatives

Weber-Fechner law

brain compresses information logarithmically

social classes as income clusters



game theory

society of agents

agents

class stratified when there is a

gap in the reward/income distribution

low envy society; 100 agents/options _



high envy society; 100 agents/options ____



envy induced class separation



agent specific levels of envy.

200 agents/options



ultimatum game_



ultimatum game

decider : divides recipient : declines/accepts

'unfair offers' often rejected> below 40%

Kirchsteiger. "The role of envy in ultimatum games" '94 Pisor et al. "Preferences and constraints: the value of economic games for studying human behavior" '20

ultimatum game with envy _



• experiment: $s \ge 0.4$

▷ envy: $\epsilon \approx 1.75$ (in units of the monetary utility)

Fehr & Schmidt, "A theory of fairness, competition, and cooperation" (1999).

strategy condensation transition _

200 agents/options



conclusions _

people compare each other

↓ ↑

social classes



C. Gros

"Self-induced class stratification in competitive societies of agents: Nash stability in the presence of envy" Royal Society Open Science 2020

social stratification transition

- \Rightarrow searching for alternative when unhappy
- ⇒ mixed strategies of low-reward agents merge
- ⇒ class stratification for realistic envy