Computer Applications and Quantitative Methods in Archaeology Conference :
Co-evolution of trade and culture: Impact of cultural network topology on economic dynamics
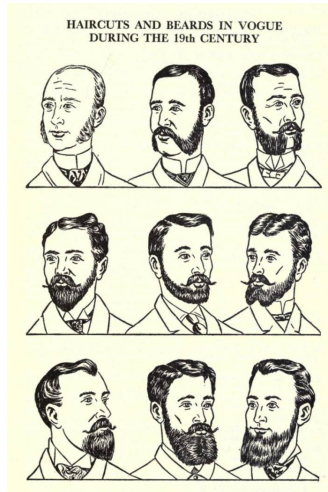
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Barcelona Supercomputing
Univ. Pompeu Fabra

Plan of the presentation

Cultural Evolution

HAIRCUTS AND BEARDS IN VOGUE DURING THE 19th CENTURY

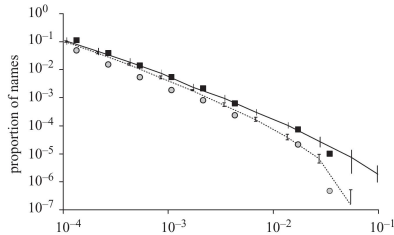How Cultural Traits Evolve?

Cultural Evolution

Similar variants distributions

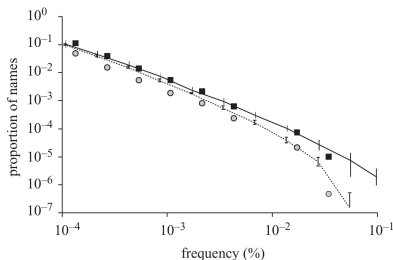

Square: male names
Circle: female names
From Bentley et al, 2004.
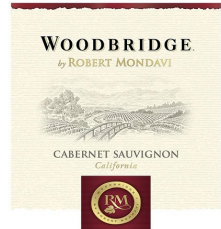
What Generate Those Cultural changes?

Simple mechanisms (Bentley et al, 2004):

- ► Random Copy
- ► Frequency biased (conformist/anti-conformist…)
- ► …

Square: male names
Circle: female names
Dotted and plain lines: model result
with different copy probabilities.
From Bentley et al, 2004.

What happen when such mechanisms act on traits impacting economy?
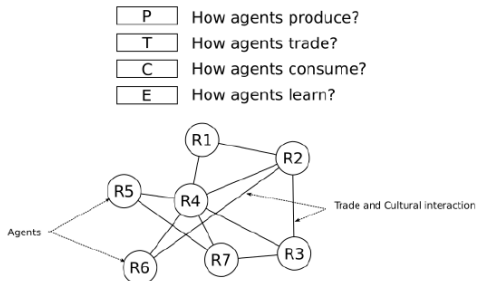
Co-evolution of Economy and Culture

Interaction between Culture and Economy

Cultural mechanisms transom Economy

$\circlearrowright$

Economy influences Culture

A General Agent Based Framework

A General Agent Based Framework

Two main components:

1. Economic side: Bartering Economy (Gintis 2009),

2. Cultural side: "copy the most successful" (Bentley 2006).

The Model

1. The Economy & the Barter Mechanism

- N goods
- M Agent $\begin{cases} \text{a quantity of each Goods} \\ N \text{ values attributed to each goods} \end{cases}$
- Agents *produce* one good and *exchange* it to obtain the other goods.
- After the exchange, the agents *consume* all goods

The Model

2. Cultural Mechanisms

Every step:

- Economic activity (cf. previous slide).
- A *score* is given following $f(q_n)$ a shared & fixed "utility function".

After 10 steps:

- Less successful agents *copy* the most successful (Biased-Copy).
- Given a probability μ the value attributed to some goods is modified (Innovation/Mutation)
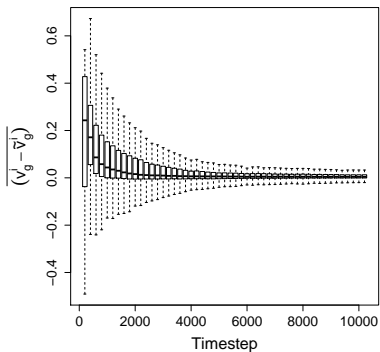
Experiments

Average Length Path vs Density

Results:

Evolution of Score

Results:

Figure: Example for 3 goods and 500 agents

@ Equilibrium: personal values $\rightarrow$ optimal (shared) values.

Summary

- ▶ A local copy mechanism alone is enough to bring the global economy to an optimal equilibrium.

- ▶ The topology of the network where this copy mechanism occure influence the dynamics of the system

Case Study

What was the nature of Roman economy?

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Thank for you attention!