Ultrasociology
How Cultural Evolution Helps Us Understand the Rise of Complex Societies in Human History

Peter Turchin
University of Connecticut and Evolution Institute
International Space Station

- Built by Roscosmos, NASA, ESA, JAXA, CSA
- Cost: $150 bln
- 3 mln people-years
- >1 bln citizens in participating countries

Humans are capable of cooperating in huge groups of strangers
Empire State Building, 1930

Amiens Cathedral, 1220

Great Pyramid of Giza, 2540 BC

Göbekli Tepe, 9th millennium BC
# Social Scale

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<th>Polity Types</th>
<th>Time (kya)</th>
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Social scale of a leaf cutter ant colony: 1,000,000s
A Social Scale

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Humans are champion cooperators – an “ultrasocial species”
The Puzzle of Ultrasociality

- **Ultrasociality**: extensive cooperation among very large numbers of genetically unrelated individuals
- Ultrasociality was a key glue holding together historical mega-empires
- But cooperation is fragile and is easily destroyed by “free-riding”
- How did it evolve?
- This is one of the unresolved Grand Questions of social science

Achaemenid Empire: 2.5 kya
Major Themes

• Cliodynamics: History as Science
• 3,000 years of cultural evolution in Afroeurasia ("the Old World"): a mathematical model
• Data: testing theories of cultural evolution
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Evolution of Large-Scale Complex Societies: Many Theories

• Resource base (agriculture)
  - Childe, White, Service, Diamond

• Social differentiation and class structure
  - Marx, Engels, Patterson

• Warfare and circumscription - Carneiro

• Economics and trade, problem-solving and information processing, ...

• Cultural Multilevel Selection
  - Boyd, Richerson, D.S. Wilson, Bowles
The Central Question: How can ultrasocial traits spread?

- It is not a simple matter of accounting for their benefits for integration of large-scale societies
- these institutions have significant costs
  - and historical record indicates that they repeatedly collapsed when societies scale down
- need an evolutionary mechanism to explain the spread of such traits despite the costs
Should rulers and elites be self-serving?

Or should they act in prosocial ways that benefit governed populations?
I am Tiglath Pileser the powerful king; supreme King of Lashanan; King of the four regions; King of all Kings; Lord of Lords; the supreme; Monarch of Monarchs; the illustrious Chief ...
Ashoka Maurya (III c. BC)
I made provision for two types of medical treatment: medical treatment for humans and medical treatment for animals.
Wherever medical herbs suitable for humans or animals are not available, I have had them imported and grown. Along roads I have had wells dug and trees planted for the benefit of humans and animals.

Beloved-of-the-Gods speaks thus:
My magistrates are working among the people. The hearing of petitions and the administration of justice has been left to them so that they can do their duties confidently and fearlessly and so that they can work for the welfare, happiness and benefit of the
Despotism versus Prosociality

• Despotism serves rulers and the elites
  - increases their genetic fitness!
• But it undermines cooperation between the rulers and the population
  - despotic societies are fragile and liable to collapse

Thus:

• Inequity norms tend to increase within societies: inequality and despotism grow
• Competition between societies weeds out despotic societies: prosocial and equity-promoting norms spread
How can we test such theories?

Cliodynamics: History as Science

• Define the question
• Propose two or more alternative explanations/theories
• Use mathematical models to extract predictions from theories
  - predictions that disagree about some observable aspect of reality
• Put together data to adjudicate between the theories
• Repeat as necessary
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ULTRA SOCIETY

how 10,000 years of war made humans the greatest cooperators on earth

PETER TURCHIN
Evolution of Ultrasocial Norms and Institutions: A Model

- Historical period: 1500 BCE – 1500 CE
- Spatial domain: Afroeurasia ("Old World")
- Space is divided into 100 x 100 km cells
  - regional communities ≈ complex chiefdoms/archaic states
  - the focus is on the evolution from mid-range → large-scale societies (macrostates and mega-empires)
War, space, and the evolution of Old World complex societies

Peter Turan*+, Thomas E. Currie*, Edward A. L. Turner*, and Sergey Gavrilets*

*Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT 06235-3042; **Centre for Ecology and Conservation, Department of Biology, University of Exeter, Cornwallis Rd, WELLS, United Kingdom; †Southwest Forest Experiment Station, USDA FS, Flagstaff, AZ 86001, and ‡Department of Ecology and Evolutionary Biology, and Department of Mathematics, National Institute for Mathematical and Biological Synthesis, University of Tennessee, Knoxville, TN 37996.

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How did human societies evolve from small groups, integrated by face-to-face cooperation, to huge anonymous societies of today, typically organized as states? Why is there so much variation in the ability of different human populations to construct viable states? Testing theories are usually formulated as verbal models and, as a result, do not yield sharply defined, quantitative predictions that could be unambiguously tested with data. Here we develop a cultural evolutionary model that predicts where and when the largest-scale complex societies arise in human history. The central premise of the model, which we test, is that costly institutions that enable large human groups to function without splitting up evolved as a result of intense competition between societies—primarily warfare. Warfare intensity, in turn, depended on the spread of historically attested military technologies (e.g., chariots and cavalry) and on geographic factors (e.g., rugged landscapes). The model was simulated within a realistic landscape of the African landscape and its predictions were tested against a large dataset documenting the spatiotemporal distribution of historical large-scale societies in Africa from 1,500 BCE and 1,000 CE. The model predicted pattern of spread of large-scale societies was very similar to the observed one. Overall, the model explained 86% of variance in the data. An alternative model, omitting the effect of military technologies, explained only 16% of variance. Our results support theories that emphasize the role of institutions in state-building and suggest a possible explanation why a long history of cooperation is positively correlated with political stability, institutional quality, and income per capita.

cultural evolution | social complexity | ultranasality

Humans have the ability to live and cooperate in large groups of genetically unrelated individuals (what can be termed “ultranasality”) (1, 2). The central conceptual issue that this paper addresses is what mechanisms facilitate the spread of the necessary norms and institutions that enable human groups to function at the scale of millions of individuals (3–5). Social scientists have proposed a number of theories to explain the emergence of large-scale societies, emphasizing such factors as population growth, warfare, information management, economic specialization, and long-distance trade (6–10). However, because existing theories are usually formulated as verbal models, the causal mechanisms underlying these theories are not always explicit. Understanding how ultranasal norms and institutions spread is not a simple matter of their benefits for large-scale societies. Collective action problems, which stem from the tension between public interest and private costs, yield cooperation and private costs borne by cooperating agents (11). Inevitably arise when large groups of people need to cooperate in the production of public goods. Any theory that does not explain how societies find ways to solve these problems must be incomplete.

Ultranasal Norms and Institutions

Social norms and institutions are among the most important ways of solving the collective action problem (4, 12, 13). Although much theory building has focused on solving cooperative dilemmas within groups of individuals, collective action problems can arise at all levels of organization (1). For example, an arche site may arise when several villages are unified (by conquest, by ethnic marriage, etc.). In order for the state to function well and preserve its integrity, its constituent units (e.g., chiefdoms, now provinces) have to cooperate with each other (at the very least, the regional elites need to cooperate with the core).

As an example of an ultranasal norm, consider generalized trust (14). Properly to trust and help individuals outside of one’s ethnic group has a clear benefit for multilocal societies, but ethnic groups among whom this ultranasal norm is widespread are vulnerable to face-to-face ethnic groups that restrict cooperation to outsiders (e.g., ethnic militias). An example of an ultranasal institution, much discussed by historians and political scientists, is government by professional bureaucracies (15). Other examples include systems of formal education, with the Mandean educational system in China as the most famous example, and internalizing religions. (e.g., the Zhou dynasty, Han China (Confucianism), and Manchu Empire (Buddhism).

Our theoretical framework for understanding the evolution of social norms and institutions is provided by cultural multilevel selection (CMLS) (5, 17). Because the benefits of ultranasal institutions are only felt at larger scales of social organization, and costs are borne by lower-level units, fragmentation into lower-level units often leads to a loss of such institutions. For example, when a territorial state fragments into a multitude of provincial units, ultranasal institutions such as systems of formal education, generating hierarchies in the state or other higher units may be gradually lost. As happened, e.g., in pairs of

Significance

How did human societies evolve from small groups, integrated by face-to-face cooperation, to huge anonymous societies of today? Why is there so much variation in the ability of different human populations to construct viable states? We developed a model that uses cultural evolution mechanisms to predict where and when large-scale complex societies should arise in human history. The model was simulated within a realistic landscape of the African lands, and its predictions were tested against real data. Overall, the model did an excellent job predicting empirical patterns. Our results suggest a possible explanation as to why a long history of statebuilding is positively correlated with political stability, institutional quality, and income per capita.

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*To whom correspondence should be addressed. E-mail: peter.turan@uidaho.edu.

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‡Available online through the PNAS open-access option.

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General Logic of the Model

- **The goal:** to understand how cultural traits that enable larger-scale organization can spread despite costs

- **Cultural multilevel selection (CMLS)**
  - ultrasocial traits: decline within groups, but increase the competitive ability against other groups
    - greater social and political stability
    - more effective at warfare

- **Groups compete via warfare, with winning groups imposing their culture on the defeated**
Conceptual core of the model

spread of military technologies

intensification of warfare

evolution of ultrasocial traits

rise of large-scale societies
Spread of ultrasocial traits predicted by the model
Spread of “macrostate density” predicted by the model

1500—500 BCE

500 BCE—500 CE

500—1500 CE
Major Themes

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Empirical tests: testing the Afroeurasia model

• Focus on largest territorial polities
  – Cut-off point: territory ≥ 100,000 km² at peak
• Period: 1500 BCE – 1500 CE
• Spatial extent: Eurasia and Africa
• Output: “imperial density maps”
  – separately for each millennium (eras I, II, III)
“Imperial density” in Afroeurasia: 1500 BCE - 500 BCE (macrostates with territories > 100,000 km²).

Focus here: on one aspect of social scale
“Imperial density” in Afroeurasia: 500 BCE - 500 CE
(macrostates with territories > 100,000 km²)
“Imperial density” in Afroeurasia: 500 CE - 1500 CE (macrostates with territories > 100,000 km²)
Real Data

Simulated Data

Overall model fit
$R^2 \approx 0.65$
The huge corpus of knowledge about past societies collectively possessed by academic historians is almost entirely in a form that is inaccessible to scientific analysis, stored in historians’ brains or scattered over heterogeneous notes and publications. The huge potential of this knowledge for testing theories about political and economic development has been largely untapped.

**Project goals:**

- Build a web of facts about past societies, connected along spatial, temporal, thematic, and conceptual dimensions
- Test and reject theories of sociocultural evolution
Seshat Status, April 2017

• 34 NGAs
• >400 (quasi)polities
• 1500 variables
• 180,000 Seshat records
• 600,000 triples (RDF)
General Conclusions

• The main evolutionary force driving the evolution of ultrasociality is multilevel selection

• Competition between societies
  - war: for most of human evolutionary history
  - recently, gentler forms of societal selection

• Evolutionary logic
  - larger societies win over smaller ones
  - more equitable societies win over despotic ones
How Does Ultrasociality Evolves?

• To cooperate societies need society-level integrative traits, e.g. institutions
  - elaborate governance institutions
    • interlocked executive, legislative, judiciary branches
    • norms and institutions restraining military leaders
  - analogy: evolved multicellular organisms

• The only way such society-wide traits can evolve is by selection on whole societies

• Competition between societies: the evolutionary engine of ultrasociality
Deep History

• Pleistocene (2.6 mya): 'struggle for existence' against harsh, rapidly changing environment
  - indirect competition
  - evolution of culture allowed rapid adaptation to changing conditions

• Holocene (12 kya): struggle against other human groups
  - direct competition: warfare
  - evolution of very large-scale societies
  - and institutions to integrate them
Ancient and Medieval History

• Horse-based warfare
• Projectiles: compound bow, siege engines
• Metallurgy: bronze, iron, steel
After 1500: Europeans as “White Inner Asians”
Today

• Struggle to produce high quality of life for citizens, e.g.
  - transition to a market economy in USSR
  - Arab Spring
  - populations “voting with their feet”

• War (threat of war) of less importance

• Cultural selection by imitating traits of successful societies
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