The Transition to Specialized Decision Making

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Humans are an **outlier species**. Why **one species** of 8.7 million?

1) **Biologically dominant.**
   - Cycle more nitrogen than all terrestrial life combined *(Vitousek et al 1997)*.
   - 100 x more biomass than any large species that ever lived *(Lynas 2004)*.
   - Humans & domestic animals >98% of terrestrial vertebrate biomass *(Smil 2002)*.
   - > 50% of earth’s land surface modified by humans *(Hooke 2012)*.

Biological dominance began before the Holocene and before agriculture. ~70 million **hunter-gatherers** lived on every continent of earth at the end of the Pleistocene!
There are important institutional developments prior to agriculture or the state.

Some HG developed social **groups >1000 individuals**. Inter-group **exchange of resources, technology, (>1,000 km)**.

HG developed **complex institutions** *(insurance, banking, social security, common defense, adjudication, social stratification, capitalism, slavery, monumental architecture)*.

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Göbekli Tepe, Turkey, 11 kya
hunter-gatherers constructed megalithic structures

Poverty point, La (3,400kya)
Giant Mounds
238,000m³ fill in 3 months
Did another transition take place in ancestral human societies that allowed 70 million people → 7 billion.

And this!

1.44 × 10^{14} \text{KWh/yr} of extra somatic energy capture (All humans = 6×10^{12} \text{KWh somatic energy})

Only species to leave earth

Olympics: 204 nations cooperate in one complex institution

Economic mutualism between billions of unrelated individuals
The Major Transitions in Evolution (Maynard Smith & Szathmary 1995)

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1. Individual units abandon independent replication to form metaunit replicators
2. Individual units “directed” for optimal coordination and specialization
The nature of institutions have changed in ancestral societies from consensus based group norms that guide behavior, to formalized positions of authority, decision making, planning, and task implementation.

Lose consensus network ---> centralized decision and planning!

How and why is there a transition from acephelous society (spontaneously emergent regulation) to cephalized society (administrative regulation).

Does it matter?
600 million years ago -- Diffuse neural networks organized into ganglia (central nervous system, CNS)

in Urbilataria, -- sensory and motor patterns are brought under singular control.

This is a single evolutionary event never repeated?

Metazoans with a CNS have been extremely successful!

Acoelomorpha- no digestive, respiratory, circulatory or central nervous system. Diffuse nerve cells under skin.
There are a few rare cases of loss of the early central nervous system, mainly among sessile organisms. Of course plants never evolved a central nervous system.
The **bilateria** (metazoans with CNS) show:

Cellular specialists in information gathering (peripheral nervous system)
Cellular specialists in information integration and decision/planing (CNS)
Cellular specialists in directing activities of other cellular specialists (motor neurons)

Without these the transition to colonial organisms with specialized reproductive castes could never take place?
Social insects have extensive system of institutions that are regulatory:

1) Efficient communication
2) policing and punishment
3) Specialization of behavior

But there is no cephalization of insect societies. Colonies of millions (even non kin) have no leaders!

Low worker relatedness in Ropalidia Marginata
Despite multiqueen structure cooperation is effective
What’s wrong with this picture?

Princess Bala

General Mandible
Ant colonies don’t have “generals”, “ambassadors” or “queens” with power to mandate. Bees colonies don’t have CEOs that decide who forages when, where, and for how long. Instead there are genetically encoded mechanisms to produce emergent consensus.

“*The emergence of complex social behavior in leaderless and decentralized groups*” is due to “*the appearance of order at one scale from purely local interactions at a lower scale*” (S. Pratt 2011)

**Quorum responses and consensus decision making**

David J.T Sumpter and Stephen C Pratt

*Phil. Trans. R. Soc. B* 2009 **364**, 743-753
Excitatory and inhibitory signals allow “rapid” and accurate quorum sensing decisions about nest sites, food sources, predator avoidance & ??
Observations on pre-state societies
Behavior in ancestral human societies is extensively regulated by consensus based social norms

HG typically regulate all the following:

1. Mate access
2. Food production
3. Food redistribution
4. Display rights (ritual participation)
5. Access to kin and other allies
6. Political & social power
7. Forms of conflict
8. Life history
9. Public health

(Hill 2009 Ev. Anthr.)
There are **usually no governing bodies** or specialized **administrative structures** to develop or oversee norms.

Rules are facilitated through kin and ritual relations. Prescriptions and proscriptions backed by social convention, reputation, and supernatural belief.

Norms emerge through ????? and are then transmitted through social learning.
HG societies marked by **individual inequalities**, but highly cooperative

250 hunters ranked in order of hunting return rate (kg/hr hunting).

Self selection leads to some specialization (large game, small game, honey, vegetable & insect)

**No coordination of complimentary abilities. Most individuals are generalists not specialists.**
H-G life history typically includes a period when family energetic needs (breeders) exceeds family production.

**Projected typical**

- **Breeders**
  - subsidized according to kinship and social norms

**Measured**

- **Breeders**
- **Non-Breeders**

* Based on observed age/sex pyramid, age specific fertility & mortality, age specific food acquisition

**Table 1. Total net energy production by age and reproductive class, Ache population.**

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<td>19389</td>
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<tr>
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<td>-22261</td>
<td>-15109</td>
<td>54613</td>
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<tr>
<td>≥ 55</td>
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Ache
Self selected Specialization - BUT, NO named administrative or specialist positions

1. birthing assistant (self nominated, by acclaim, seniority – older woman)
2. healer (self nominated, older people, any pregnant woman)
3. clubfight duel convener (self nominated, de facto, no permanence)
4. prey redistributor (self nominated, seniority)

No chief, No tribal council, No religious leader, No named specialist “leaders”
No leaders, no decision makers, no planners.

Quorum-sensing decision observable on daily basis concerning band movement
Band level HG institutions achieve cooperation but have **shortcomings:**

1) No higher level cooperation at units above the band coresidents
2) Dependent on reputational effects (works only in small groups)
3) No adjudication of conflicts, or “final” decision making.
4) No formal mechanism for creating new rules (change is slow?)
5) No institutions that govern use of common pool resources or efficiently provide public goods (health, education, defense, public works)
6) **No efficient organization of specialization to maximize complimentarity or solve coordination problems**
Kuna of Panama

1. Economy based on farming yucca, plantains, coconuts (typical of lowland neotropics)
2. Protein derived from marine, riverine fishing, and hunting
3. **Villages** couple hours apart, ~200-800 people until 20th century, now have up to 7,000
4. Complex political-administrative structure, integrated with Kuna religion -- elaborations in larger villages and at the meta village level.
Hierarchical socio-economic/political structure. Matrilocal, Village Endogamous Prescriptions

Nuclear family (2-5)
Longhouse (20-500)
Village (12-15)
Region (3)
Territory- Comarca (4)
Tribe (80k individuals)

The four middle levels have formally recognized administrative positions. Some level of cooperation within units at each level and some competition/conflict between them.
“Onmaked Nega” the gathering house
Named administrative positions 1930-40s (most communities):

1. first chief
2. second chief
3. third chief
4. first interpreter of chiefly song lessons
5. second interpreter of chiefly song lessons
6. secretary to first chief
7. seer-shaman
8. medicine man
9. treasurer/accountant
10. tax collector
11. public prosecutor/investigator/judge (ender of conflict)
12. enforcers (policemen)
13. burier of the dead
14. collective work chiefs (assign conch messengers)
15. housing construction chiefs
16. overseer of community store (cooperative)
17. boat chief
18. beer chief (chief of female puberty rite preparation)
19. puberty rite spiritual specialist (singer)
20. song shaman (medical)
21. community healing shaman (social)
22. midwife
23. hair cutter (puberty ceremony)
24. Guild leaders
Political/administrative positions in a large village (~thousand people) 1981 [Howe 1986]:

Four primary chiefs (sacred and secular)
Two secondary chiefs
Three interpreters
Four investigators/judges
Two counselors to chiefs
Five “police”
One secretary to chief
One financial secretary
Three land management chiefs (plus one secretary)
Two land measurement/housing chiefs
Five marriage chiefs
Seven puberty ceremony chiefs (plus two secretaries)
Six trail maintenance chiefs (plus four secretaries)
Three aqueduct chiefs
Three aqueduct maintenance chiefs
Two school chiefs & one treasurer & One prosecutor/ judge
Two health center chiefs & two conflict judges & one treasurer
Multiple guild leaders and secretaries

“saila” of Ustupo community of 5,000+
His wife also leads women’s organizations
These institutions were in place before the Kuna were exposed to European societies?

Described by Lionel Wafer 1681.
Authorities have institutional rights to:

1) Tax
2) Imprison
3) Fine
4) Exile
5) Confiscate Property
6) Reallocate Property
7) Mandate communal work
8) Issue visas
9) Wage war

Abuse of power and use of power for personal gain leads to impeachment!

Chief’s modest kitchen

Barefoot chiefs
Kuna paramount chief
Impeached for
“improper sexual advances”
This system produces numerous public works and projects for the public good, efficiently solves collective action problems.
Clearing weeds from village outskirts
Summary

Acephalous societies – norms by consensus -- implicit conventions, bargaining

Vs.

Cephalized societies with delegated planning, decision and implementation authority.

All modern states and corporations are cephalized institutions. The free market economy is very efficient at selecting most efficient organization for production.

Cephalized societies consistently outcompete acephalous societies?
Any life form that made it to earth we would assume not only had a central nervous system but lived in cephalized society as well.
Observations

1. All simple societies with administrative structures that I observed had them imposed by states (still not efficient) -- transition is difficult or rare?

2. Bands have no headmen, villages often do, but no authority for information gathering, planning, decision making, task assignment, implementation!

3. Human societies with no administrative structure might accomplish But not
**Biological Generalities**

There are multicellular organisms with no central nervous system (all plants, sponges, echinoderms), but most successful animals have them. This is almost irreversible!

Superorganism colonies of individuals (eusocial animals) are all acephalous, but human societies have irreversibly (?) become cephalized.

Humans are only NOW more successful than eusocial insects!

**Why?**

1. Cephalized societies may adapt much more quickly to new conditions (central nervous system). Only a small handful of individuals need to be convinced (eg. success biased imitation). Frequency dependant adaptive valleys may be crossed more effectively (tipping points, equilibriums due to conformity bias )

2. Cephalized societies may adopt some group beneficial but individually costly institutions that are never adopted by “consensus-based” societies. Imposition by powerful individuals who don’t anticipate paying costs themselves, but will reap benefits (eg. high-casualty warfare, monogamy, productive economic systems that generate high wealth inequality)