

Focal coordination and language in human evolution, by Roger Myerson

<https://home.uchicago.edu/~rmyerson/research/focalang.pdf>

Language has enabled humans to coordinate with each other and trust each other in ways that go far beyond the capabilities of other social mammals.

But if a game has a unique equilibrium, rational coordination must conform to it.

(Much literature on game-theoretic models of human evolution has emphasized social-dilemma games, which have a unique equilibrium when played once.)

For analytical models of the impact of language in human evolution, we should consider games with multiple equilibria.

Schelling's (1960) focal-point effect: Anything that focuses the players' attention on one equilibrium may lead them to expect it, and thus to rationally play it.

Without language, there may be no way to find natural environmental cues for coordinating attention on any but the simplest equilibria.

Focusing attention on a strategy that stipulates different actions in different future conditions is particularly difficult without symbolic representation.

With language, any equilibrium could be made focal by individuals prominently describing it and recommending that everyone should act according to it.

By definition of a Nash equilibrium, a belief that others will comply with this recommendation would make compliance a best response for each player.

Here we start from an assumption that members of a species regularly interact in simple rival-claimants games, with given parameters $c > 0$ & $V > 0$, in various contexts.
(Models of resource conflict in biological game theory since Maynard Smith 1974.)

	2 claims	2 defers
1 claims	$-c, -c$	$V, 0$
1 defers	$0, V$	$0, 0$

1's payoff, 2's payoff

Table 1: A game among rival claimants to a valuable resource worth V .
[payoffs in units of incremental reproductive fitness]

This game has three Nash equilibria:

(1 claims, 2 defers) \rightarrow E payoffs: $(V, 0)$ [*1 owns the claiming rights here*],

(1 defers, 2 claims) \rightarrow E payoffs: $(0, V)$ [*2 owns the claiming rights here*],

each *symmetrically* claims with independent probability $V/(c+V) \rightarrow$ E payoffs: $(0, 0)$.

Genetic variation can yield a stable distribution of strategies in the population only if each positively-used strategy maximizes expected payoff (reproductive fitness).

If animals have no cues to break their symmetry, they can only implement the inefficient symmetric equilibrium, yielding zero expected benefits for the species.

A shared ability to identify symmetry-breaking cues can increase reproductive fitness.

Two humans with a common language might break symmetry by agreeing to allocate claiming rights by a fair coin toss: "1 claims if Heads, 2 claims if Tails."

If the loser demanded another toss, the winner could still claim confidently after replying that the first toss was what they agreed to use, so that the loser should defer. So randomized coordination requires common understanding of how players' actions should depend on an otherwise irrelevant random factor (*difficult without language*).

We may distinguish **two broad classes of simple claiming-rights criteria** that are commonly used to break symmetry among animals without language:

Political criteria assign claiming rights based on the players' individual identities, independently of the prize (as in deference to others by size or by pecking order).

Economic criteria assign claiming rights based on an individual's prior relationship with the prize (as in claims to territory that can be observably patrolled).

If our distinction between economics and politics in the social sciences is fundamental, it should have some broad extension to the biology of social animals.

Political dominance systems create pervasive inequalities within the community.

Establishing economic ownership rights may require greater social cognition.

A criterion for claiming rights can be effective only if it can be jointly recognized by the players, and communication can help to ensure common recognition.

Consider a community where condition X indicates that 1 should claim, 2 should defer.

When X is evident in the environment, 1 would want to point this out to 2.

But if X depended on something that happened previously (as in "taking turns"), then 1 would need language to remind 2 of what they did yesterday.

After diverging from other great apes, our australopithecine ancestors became bipedal, thus freeing hands for making and manipulating useful objects.

So bipedalism could lead to increased reliance on skilled manual craftsmanship.

When an object is useful and requires effort to make, others could be tempted to take it for their own use without investing in its manufacture.

Craftsmen must be rewarded for their costly development of specialized skills, but achieving maximal value from manufactured objects may involve others using them.

Thus, **bipedalism could increase the need for social structures to support economic ownership and exchange of valuable manufactured objects.**

For a community of social animals to develop a culture of complex rules for claiming rights, the young should be innately ready to learn these rules from their elders.

In such a community, it would be adaptive for young to have innate interest in learning their society's rules for claiming rights, how to claim when elders would approve.

Then principles for socially accepted claiming rights become something to talk about.

Neurological systems that humans use for language are closely related to those used for complex motor skills, which also have a recursive structure (Lieberman 2002).

Language helps clarify terms for complex transactions to avoid conflict: "if you give me that egg then I'll let you use my handaxe today, but I'll reclaim it tomorrow."

*So the **origin of human language** (in both supply and demand) may be rooted in the manual dexterity that followed from bipedalism.*

When ownership in rival-claimants games is allocated by learned cultural principles, communities can get competitive advantages from better-adapted principles.

In successful societies, some forms of economic ownership could require a social status which is politically earned by cooperative contributions to public goods.

Consider a community where individuals play frequent rival-claimants games but also occasional social-dilemma games for a high-value public good (big-game hunting).

Dependence of socially recognized claiming rights on past actions can be used to support equilibria with positive cooperative contributions to public goods.

Example: $k \in \{0, 1, \dots, m\}$ individuals cooperating in hunt at private cost D yields probability k/m of benefit B to each of n in the community, $nB/m > D > B/m$.

Cooperation is promoted by an expectation that refusing to cooperate could cause an individual to lose claiming rights in at least $(D - B/m)/V$ rival-claimants games.

A bully consistently claims in situations where he has no socially recognized rights, which generates costly conflicts that he could have avoided by deferring ($-c < 0$).

Bullying could be advantageous only if a reputation for bullying would cause others to revise their social expectations and start deferring to the recognized bully.

Other possible responses: ostracism (the bully loses all socially recognized rights), and punishment (attacking the bully is seen as contributing to a public good).

Fighting rival societies is also an operation in which a society's chances to grow may be improved by its members acting as a disciplined cooperative team.

Rewards of social status for valor motivates martial risk-taking in human societies, but not in chimpanzee societies (Zefferman & Mathew 2015).

Chimpanzees do not need language to understand that competition to be alpha male may require contenders to accept some risks of costly conflict with each other.

But even this risk may be minimized in a well-adapted system of chimpanzee politics, where a contender may induce others to accept his leadership by a long series of limited challenges to the incumbent's authority (De Waal 1982).

The alpha male gains rights to claim mating opportunities, but needs a coalition to support his status (as any two cooperating adult males could kill one alone).

With language, a contender might offer to respect a supporter's mating rights with one particular female in the community, and then a reputation for keeping such promises would become essential to maintain his coalition.

Thus, introducing language into chimpanzee politics could cause a transition from rank-biased promiscuity toward pair-bonding like human societies.

Social animals avoid inbreeding by having at least one gender (chimpanzee females) regularly leave their birth community to find mates in another community.

Then **language and pair-bonding enable individuals to recognize kinship links across communities** (*e.g.: cooperation between a female's husband and brother*).

So our ancestors could form **multi-band societies or tribes** including many local communities that share a common culture (Richerson & Boyd 1999, Chapais 2008).

Then boundaries of tribal identity matter, because interactions with outsiders involve risks of conflict from different expectations about rights in rival-claimants games. So intra-tribal relationships may be better for avoiding conflict, as the tribal culture provides a shared understanding of ownership in rival-claimants games.

A system of naming individuals (personal name & home-community name) would allow reputational incentives for cooperation to extend across tribal communities.

Thus, although the partition of the world into nation-states is a recent development, the existence of social structures that facilitate constructive relationships between individuals from widely separated communities may be ancient.

Conclusions:

Our story has conjectured a sequence of developments in human evolution:

bipedalism → manual skills and manufacture of valuable objects

→ greater returns to social support for complex forms of economic ownership

→ innate readiness to learn social norms for ownership rights, with language

→ dependence of ownership rights on prosocial behavior (cultural adaptation).

Also: language → pair bonding (moderating male dominance competition)

→ multi-band tribal societies.

Game-theoretic models of human evolution offer simple perspectives on human nature.

Models of repeated social dilemmas have suggested a nature of **parochial altruism**,

where parochial means identifying with a group and favoring its members.

Models of rival-claimants games, which have multiple equilibria, enable us to analyze the role of human language in promoting complex strategic coordination.

These rival-claimants models suggest a natural tendency to **litigious compliance**, and an aversion to risks of interacting with outsiders who have different cultural norms.

These notes:

https://home.uchicago.edu/~rmyerson/research/focalang_notes.pdf