

Cultural Evolution and the Paradox of Diversity



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Humans are a different kind of animal, dependent on not just genes but culture. We rely heavily on this socially acquired knowledge.

Over generations culture has shaped the human genome. Our guts are too short and our jaws are too weak for raw food and yet we don't have instincts for cooking or even fire making, nor could we easily figure these out in isolation. Instead, we are born into a world of cooked food and plenty to learn, both of which are necessary for survival. That body of knowledge, what we call *culture*, has been evolving for generations through innovation and accumulation. This process of cultural evolution provides a framework for understanding innovation and designing policies that maximize innovation by leveraging policy levers like diversity.

The Paradox of Diversity

Diversity is a paradox. Governments and organizations often push for greater diversity and tolerance for diversity, because the human tendency is toward squashing difference and selecting others like ourselves. But diversity is a double-edged sword.

On the one hand, innovations are often diverse ideas recombined, a process of intellectual arbitrage—discoveries and technologies situated in one discipline, but drawing on a key insight from another. On the other hand, diversity is, by definition, divisive. Without a common understand-

ing, common goals, and common language, the flow of ideas in social networks is stymied, preventing recombination and reducing innovation. Consider the challenge of collaborations between scientists and humanities scholars or even between scientists in different disciplines. The key to resolving the paradox is to find common ground through strategies such as optimal assimilation, translators and bridges, or division into subgroups.

Innovation is often assumed to be driven by genius innovators—the giants on whose shoulders we stand. What this view ignores are the scientists, engineers, and entrepreneurs of equal stature whose efforts led to dead ends. Instead, innovation is driven by collective processes as ideas flow through social networks, recombining in the minds of innovators and groups.

There would be a lot less simultaneous invention and people would be a lot less afraid of being scooped or beaten to market if innovation were truly a product of individual genius alone. But to understand this process, we need to understand a little more about cultural evolution.

Cultural Evolution

Cultural evolution is an extension to the mathematical toolkit of evolutionary biology into the realm of socially transmitted information. Any adaptive evolutionary system, whether genes or a genetic algorithm, requires three ingredients:

- things must vary,
- things must be transmitted without losing too much information, and
- things must be selectively transmitted such that more adaptive things persist better than less adaptive things.

Natural selection describes how these ingredients manifest and allow organisms to genetically adapt to environments over generations. Cultural evolution describes how these ingredients manifest and allow societies to culturally adapt faster than genes.

Limited Cognitive Capacity

Culture (knowledge, norms, tools, and technologies) has been accumulating to the point that today not even the smartest person could recreate the current world. Indeed, many adaptations and societal changes have evolved to deal with better ways to store and manage

collective capabilities that exceed the storage capacity of any individual brain.

Humans excel at social learning, started teaching, and got better at both. Many hunter-gatherers mostly let children hang around to learn with no direct instruction. Pastoralist societies and chiefdoms do some deliberate demonstration.

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Since the Industrial Revolution, societies have focused on one particular institution and made it compulsory: formal schooling, which helps each generation efficiently catch up on several thousand years of human progress. And despite ongoing pressures for educational innovation, we still spend longer learning, extending childhood and then creating a cultural adolescence (the period between when a person can reproduce and when she actually does) to the point that the challenge is less the ability to birth a big head and more the ability to give birth at an older age.

Most effective of all, we divided up knowledge and labor—we specialized, creating the paradox of diversity.

Specialization

Specialization makes it possible for society to exceed the capacities of a single brain.

Imagine that there are 10 things that are required to survive—food, housing, shelter, clothes, the rules of society, defense, and so on. And imagine that any individual's cognitive capacity is a maximum of 10 units. Bigger brains can store and manage more information, but it's difficult to birth anything bigger until medical interventions like Cesareans are invented.

If humans must learn all 10 things to survive, we can achieve 1 unit on each skill; 10 brain units, 10 things, skill level 1. But imagine you only have to learn half

those things because there are enough people that even if some die, enough others know the other half. Now you can dedicate yourself to getting better at 5 things and reach skill level 2. Now imagine you only need to learn 1 thing: society can now reach skill level 10. Divide it further and the sky is the limit, despite a limited 10-unit brain.

Further specialization means further increases in the average skill of a society. In a small town, there may be one general physician, but in New York a doctor may specialize on a small part of the renal system and get very good at treating that one part. Society is then able to compute almost as a collective brain.

But this creates a new challenge. Individuals become smarter at a few things and stupider at everything else, siloing specialists into disciplines and creating a challenge for coordination among different specialists.

Many of the most impactful research papers and patents are the result of intellectual arbitrage—leveraging common knowledge in one discipline to solve problems in another. The solutions to common problems are sometimes stored in separate disciplines, sometimes spread across the brains of many people.

Enhanced Innovation through Cultural Evolution and Diversity

Cultural evolutionary theory predicts three key processes that lead to innovation. Incremental innovation is the product of small improvements through partial causal models—Edison’s 99 percent perspiration. Experts often understand a small part of their larger discipline better than others do, but large innovations are typically recombined ideas or simply serendipity.

Cultural evolution predicts three levers of innovation that increase the likelihood of discovery:

- *Sociality* describes the size and interconnectedness of a society—larger, more interconnected societies have

more ideas that can more easily flow through denser social networks to meet and combine.

- *Transmission fidelity* denotes better means of communicating information to allow information compression, easier learning, simplified steps, discovery of fundamental principles, and more information stored per head.
- *Diversity*, as explained above, is the double-edged sword, which can help or harm innovation.

Resolving the tension between diversity and selection is at the core of a successful innovation strategy. And there are many possible solutions.

Some dimensions of diversity matter more than others—without a common language, communication is difficult. On the other hand, food preferences create little more than an easily solved coordination challenge for lunch. But between these are many dimensions where optimal assimilation may be desirable and traits can be optimized, such as psychological safety so people feel free to share unorthodox ideas.

Other strategies include interdisciplinary translators. In my role at the Database of Religious History—a large science and humanities collaboration—we have benefited from a few scholars trained in both to bridge the gap. Innovation can also be divided into independent groups, coordinating within the group but competing against others trying different strategies, as is the case in competition between firms.

Cultural evolution and dual inheritance theory—the culture-gene coevolutionary framework—represent the best approximation of a theory of human behavior. Like other formal unifying frameworks of the past, from natural selection to the periodic table, it helps us both make sense of existing knowledge and design new approaches to tackle the challenges of the future.