Why We're Still Here: A Simulation of Human Evolution, War, and the Power of Getting Along

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***Abstract*—This study builds a discrete-event simulator with a clear purpose: to recreate the messy, competitive reality of evolution when multiple Homo species shared the same terrain and fought—knowingly or not—for survival. The simulation zooms in on the early Holocene, about 11,650 years ago, to test what might have happened when Homo sapiens, Homo neanderthalensis, and Homo erectus overlapped in space and time.**

Instead of guessing or speculating, this work runs the tape forward using high-performance computational models. It doesn't just ask who survived, but why. The simulation tests the role of social structures, cognitive differences, and competition for limited resources. The results are sharp: cooperation beats isolation, and strategy matters more than brute strength.

What emerges is not a romantic tale of survival, but a data-driven look at extinction. Social alliances, flexible thinking, and collective behavior turn out to be evolutionary game-changers. This project doesn't just add to our understanding of ancient human dynamics—it sets the stage for a new way of studying evolution itself: not as a slow drift, but as a dynamic system where complexity, pressure, and choice collide.

I. Introduction

To understand how Homo sapiens ended up alone at the top of the evolutionary ladder, we need to make a couple of bold but grounded assumptions.

Historical Assumption: During the early Holocene—roughly 11,650 years ago—three human species walked the Earth: Homo sapiens, Homo neanderthalensis, and Homo erectus. Then something happened. One species took over. The others vanished. Archaeological and genetic evidence confirms the timing: mass extinction of the "minor" species, followed by the global rise of sapiens as the last hominin standing.

Evolutionary Assumption: Of all the theories floating around about why this happened, this study sides with the controversial one. Yuval Noah Harari puts it bluntly: sapiens didn't just outlast the others—they wiped them out. Not by chance, not by climate, but by conquest. Genocide, not drift.

Why did sapiens win? Not because they were stronger—neanderthalensis had the muscle. Not because they reproduced faster—erectus had that edge. Sapiens won because they could think in stories, believe in symbols, and—most importantly—cooperate in large numbers with strangers. That's not a small evolutionary tweak. That's a revolution.

This research takes those premises and builds simulations to test them. It doesn't look for a single truth, but explores a space of possibilities—scenarios where social complexity, cognition, and resource conflict play out across competing species. The results offer insight into what likely tipped the scales in favor of sapiens, and how imagination, not just adaptation, might have shaped our survival.

II. Methodology

You want to simulate extinction? Fine. But first, you need a world that makes sense. Then, some creatures to live in it. And rules to decide who thrives, who dies, and who gets eaten along the way. This section breaks it all down.

A. Environment Structuring

The world is built as a 2D grid. Hundreds of squares, each standing in for a 10 km^2 chunk of territory—call them colonies. Think of the grid as a simplified map where movement happens across adjacent colonies, like stepping stones. This abstraction isn't about geography; it's about interaction. Who ends up where, and what happens when they meet.

B. Species Modelling

Species are built from the ground up. First, you've got individuals. Group a few of them—same species, same campfire—and you get a clan. Several clans of the same species make up the whole species. That's it. Just like real prehistoric life: no nations, no borders—just blood ties, territory, and survival. The model sticks close to anthropological findings about clan-based human societies.

C. Stochastic Evolution

Life isn't deterministic. This model respects that. Inspired by Harari's take, the simulation starts with each clan randomly dropped into its own colony. They reproduce, they die—business as usual.

But then comes migration. They move when resources run low. Sometimes they find empty land and start over. Sometimes they run into trouble—other species, other clans. That's when things get bloody. War breaks out. Or, if they're sapiens meeting sapiens, something amazing happens: they talk. They team up. And that's the evolutionary twist this model explores.

D. Mobility Modelling

Clans don't sit still. Every so often, one picks up and moves to a neighboring colony. It's a dice roll—timing, direction, outcome. The cost? No births during the journey. No new mouths to feed when you're already starving.

If they land somewhere empty, it's colonization. They start reproducing again. More mouths, more power. But if the colony's already taken—by a rival species—it's war.

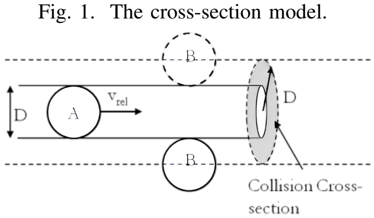
After the dust settles, if they win, they take over and start colonizing. If they lose, well, they're gone. Rinse and repeat for every clan, every species, across the map.

E. Combat Modelling

Now for the fun part—war.

This isn't a Hollywood brawl. The simulator treats it like physics. Think of individuals like particles in a gas—randomly bumping around in a confined space. Borrowing straight from thermodynamics, the model calculates how often these "particles" (people) collide. Each collision is a fight. One dies, the other keeps moving, looking for the next clash. But beyond the idea, there's also mathematics.

Fig. 1. The cross-section model.



If you've got N particles (or people), moving around in a volume V, with a speed v, and a size (cross-sectional radius) d, the average number of collisions in a small time window ∇t is:

$$n = \frac{N}{V} \pi d^2 v \nabla t \tag{1}$$

Want to know how many collisions per second? Just divide by the time:

$$\lambda = \frac{N}{V} \pi d^2 v \tag{2}$$

This gives you the expected number of encounters per unit time — that is, how often people randomly run into enemies on the battlefield.

The math is clean: more enemies in a tight space means more clashes per second. Fewer enemies? Fewer fights. Over time, one side runs out of fighters. Game over.

But here's the twist: sapiens clans don't fight each other. When they meet, they form alliances instead. Instantly. Whether it's during migration or even mid-battle, sapiens recognize kin and team up. That's the strategic edge the others don't have. And in this model, it makes all the difference.

III. Experiments

To understand how sapiens came out on top, we run experiments—not in a lab, but in a virtual world built to play out decades in a few hours. Here's how the simulator is put together, how we feed it data, and what comes out.

A. Simulator Architecture

At its core, the simulator is just a machine that keeps track of who's alive, where they live, and what they're doing. Clans and individuals are stored in dictionaries—structured data, not guesswork. Colonies are the nodes in the system, and time marches forward through discrete events: births, deaths, migrations, arrivals, and battles.

Now, it's not just about letting the simulation run wild. The real complexity lies in the control flow—especially when we hit migration or war. When a clan is about to move or fight, we shut off births. No babies during war. Once they settle again, the birth rate jumps. Simple logic, brutal realism.

B. Input Parameters Selection

Every simulation needs numbers—otherwise it's just hand-waving. So we set some ground rules.

Each clan gets a reproduction rate of 0.15. When they settle new territory, that rate gets a bonus—0.85—thanks to new resources and room to grow. The chance of an individual improving (stronger, smarter, better) is 0.5, and if they do, it boosts them by a factor of 0.25. Life expectancy? About 15 years—short and harsh, like it probably was.

We use 25 colonies to keep things manageable, and a dictionary to track which clan belongs to which species, how many members it has, and where they're starting. Migration gets triggered randomly, somewhere between 0 and 5 years after a clan settles in. This adds just enough chaos to keep things interesting.

C. Experimental Setup

The rules are in place. Now we play the game.

Each simulation starts with 15 clans—five for each species—and 25 individuals per clan. From there, we hit "run" and let it evolve. The simulator keeps going until we hit 45 years (about three generations), or until a species disappears completely.

Now, let's be clear: this is computationally heavy. To get solid, statistically meaningful results, we ran 10,000 full simulations. That's roughly 72 hours of continuous processing. The outcome? A confidence level of 95%, and results with an accuracy of 0.95.

Here's what we found:

TABLE I
THE EXTINCTION RATE FOR EACH SPECIES.

Species	Extinction Rate
Homo Sapiens	**0.2187**
Homo Erectus	0.6575
Homo Neanderthalensis	0.7269

These numbers aren't just statistics. They tell a story. Sapiens survived far more often than the others. Why? Not because they were stronger. Not because they reproduced faster. But because they cooperated.

D. Interpreting the Results

Let's dig deeper.

Fig. 2. The evolution of species over time.

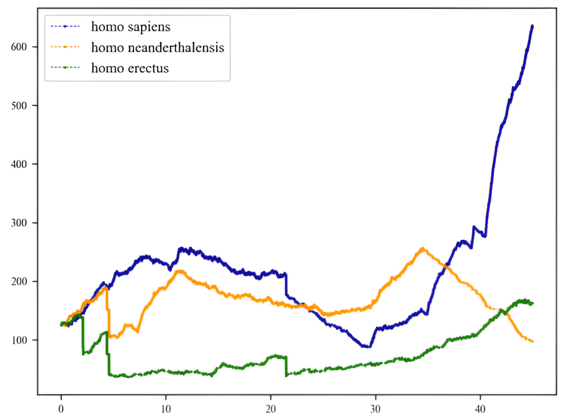


Figure 2 shows one typical run from our 10,000 simulations. You can see population booms and busts.

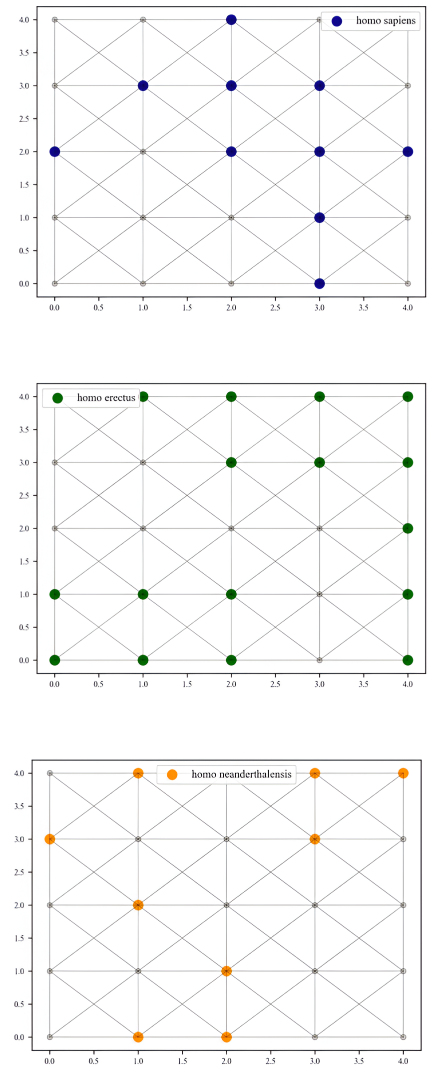
Around year 5 and year 20, populations nosedive. Those crashes? War. Fast, brutal, clan-vs-clan annihilation. One particularly nasty clash happens around year 2.5—erectus fighting erectus. Then at year 5, erectus gets slammed again, this time by neanderthalensis. Later, around year 20, sapiens joins the fray.

But it's not all blood and ashes. Look closely: some upticks in the population come right after colonization. That's no coincidence. Colonization gives a clan exclusive access to resources—and when that happens, reproduction spikes.

Now, not all declines are dramatic. Some are slow burns, caused by long migrations or birth cycles being paused. The simulator doesn't add drama where there is none—it just reflects the math.

Figure 3 shows the same scenario from a spatial angle. Colonies are mapped as nodes, connections between them as edges. Over time, you can see who conquered what, and where clans chose to settle. The map tracks their footsteps through prehistory.

Fig. 3. The colonization history.



IV. Conclusion

What makes a species survive while others vanish? That's the question we tried to answer—and the simulations gave us a pretty compelling story.

When we pit sapiens against neanderthalensis and erectus in thousands of virtual histories, one pattern stood out: sapiens survives more often. Not because they were stronger. Not because they had more babies. But because they were better at something deceptively simple—working together.

That's the whole point. Harari talked about this idea years ago, and our results back him up: the real edge wasn't brawn or brute instinct—it was brainpower turned into cooperation. Sapiens formed alliances. They built trust beyond bloodlines. They didn't just fight—they fought together. That made all the difference.

Meanwhile, the other species had their strengths—neanderthalensis with their power, erectus with their adaptability—but they lacked the flexible, large-scale social networks that allowed sapiens to survive the rough times and thrive in the good ones. Without that, they were easy pickings when conflicts broke out or when resources ran dry.

Now, let's be honest. This model isn't the real world. It simplifies things. The terrain's abstract. Climate, disease, even the way battles unfold—it's all smoothed out. So the results don't explain everything. But they do show one thing with clarity: cooperation beats isolation. Again and again.

There's room to grow. We can add smarter strategies, more realistic environments, and even bring in other species. We're just scratching the surface of a much bigger picture—where evolution isn't just about survival of the fittest, but survival of the most connected.

So what did we learn? That the story of human evolution isn't just about who had the biggest brain or the sharpest spear. It's about who could form a tribe, who could build trust, and who could share a vision of the future—even if it was just hunting the next mammoth together.

That's what made us sapiens. And that's what made us last.

References

[1] Yuval Noah Harar. *Sapiens: a Brief History of Humankind*. New York. Harper, 2015.

[2] L. M. Leemis and S. K. Park, *Discrete-Event Simulation: A First Course*, Prentice-Hall, Inc., 2005.