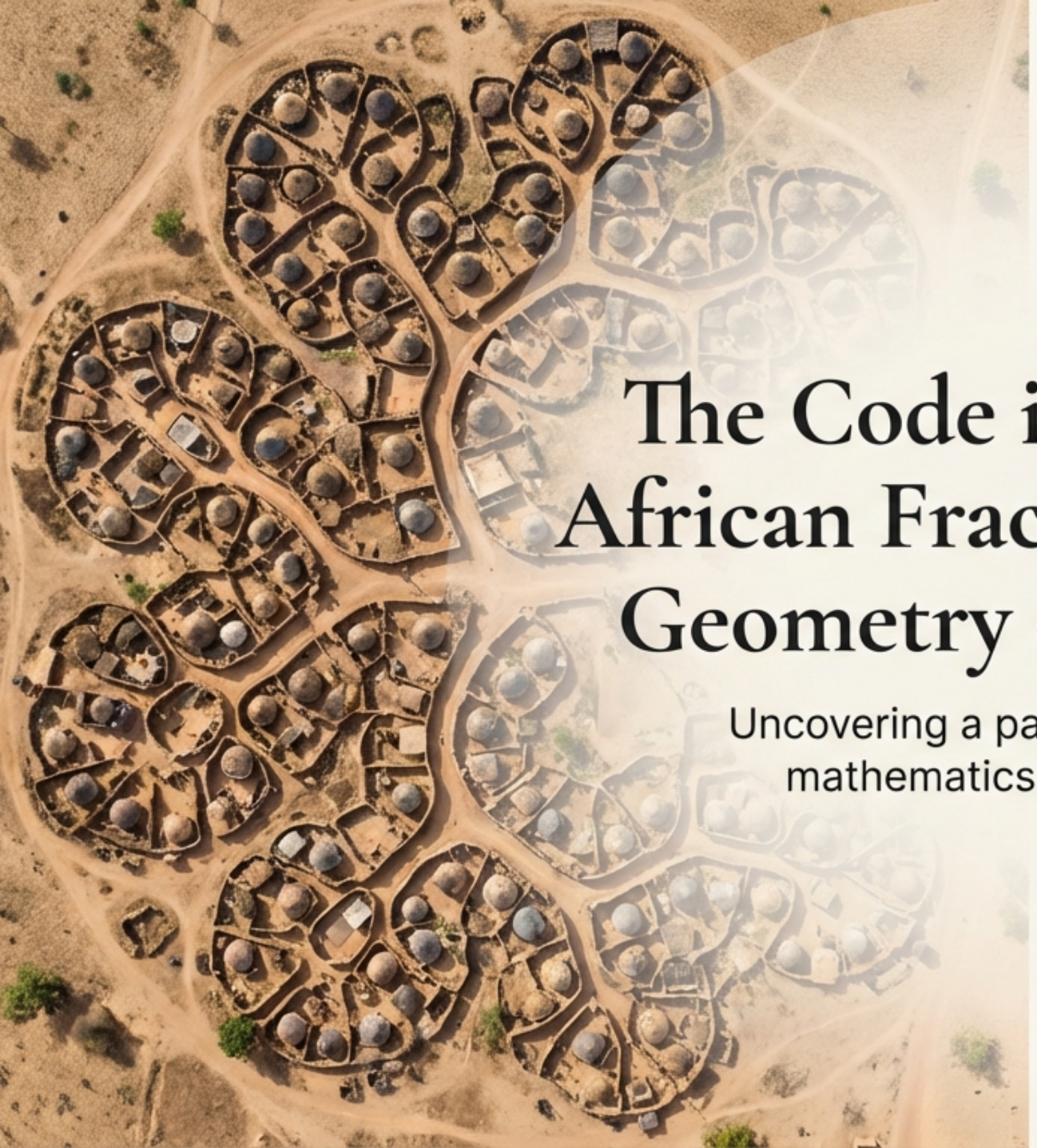
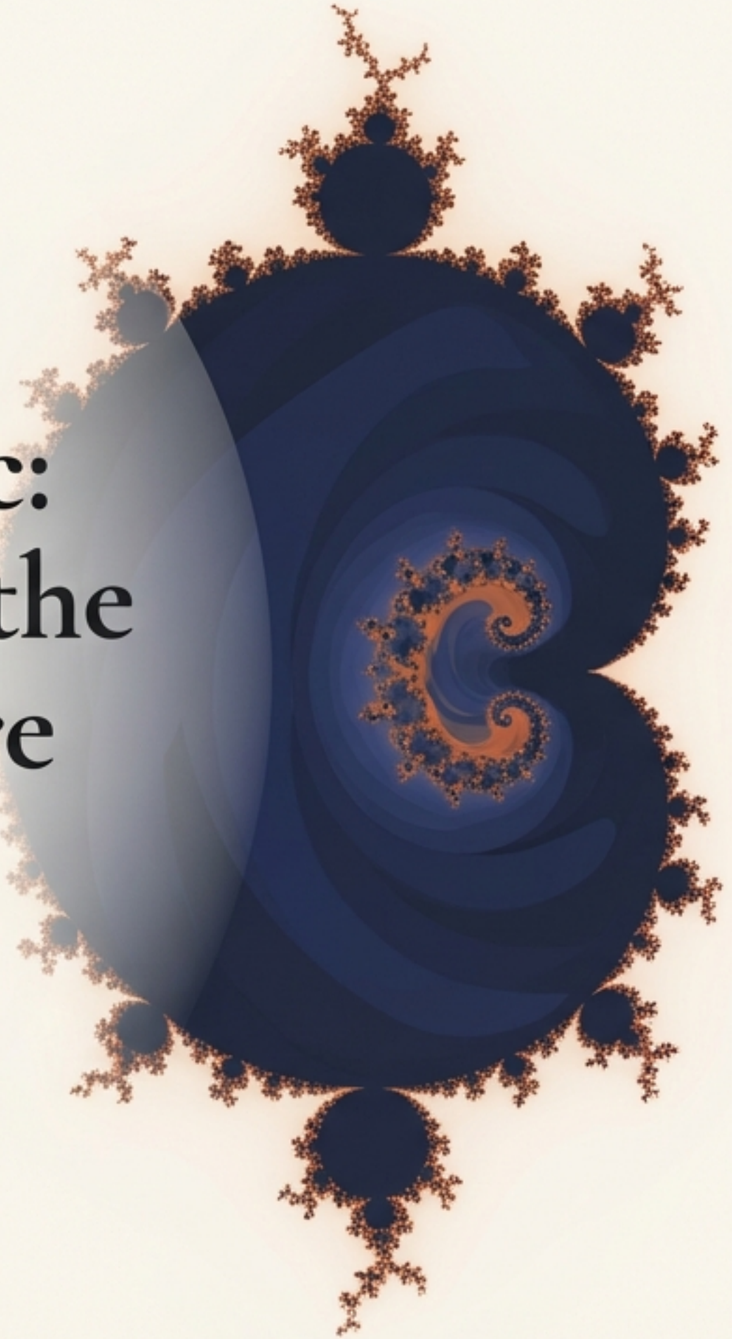


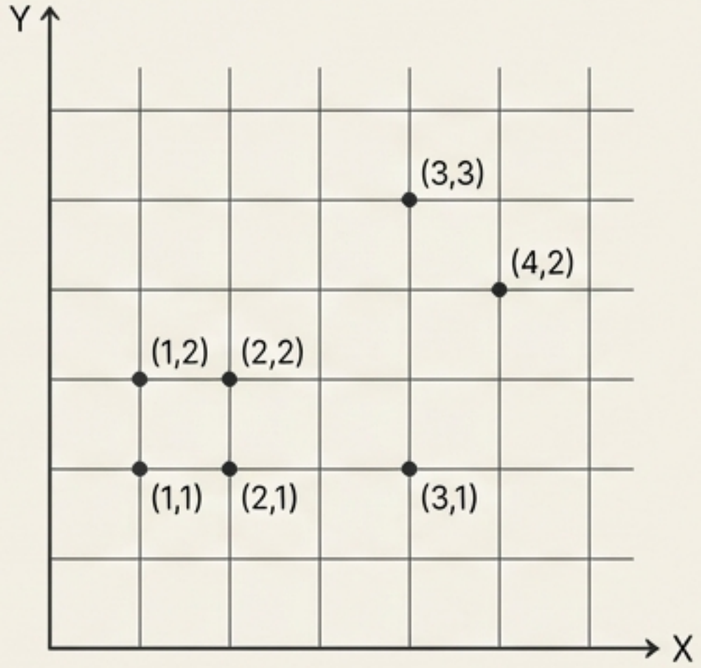
The Code in the Arc: African Fractals and the Geometry of Culture

Uncovering a parallel history of mathematics and design.



A Tale of Two Worlds: The Grid and the Grove

If visitors from another world viewed our settlements, what mathematical knowledge would they infer?



The Ordered World: Legible, Linear, Intentional.

In many American cities, numbered streets reflect a Cartesian system, prioritizing efficiency and a clear, top-down order.

The "Natural" World: Organic, Irregular, Unconscious?

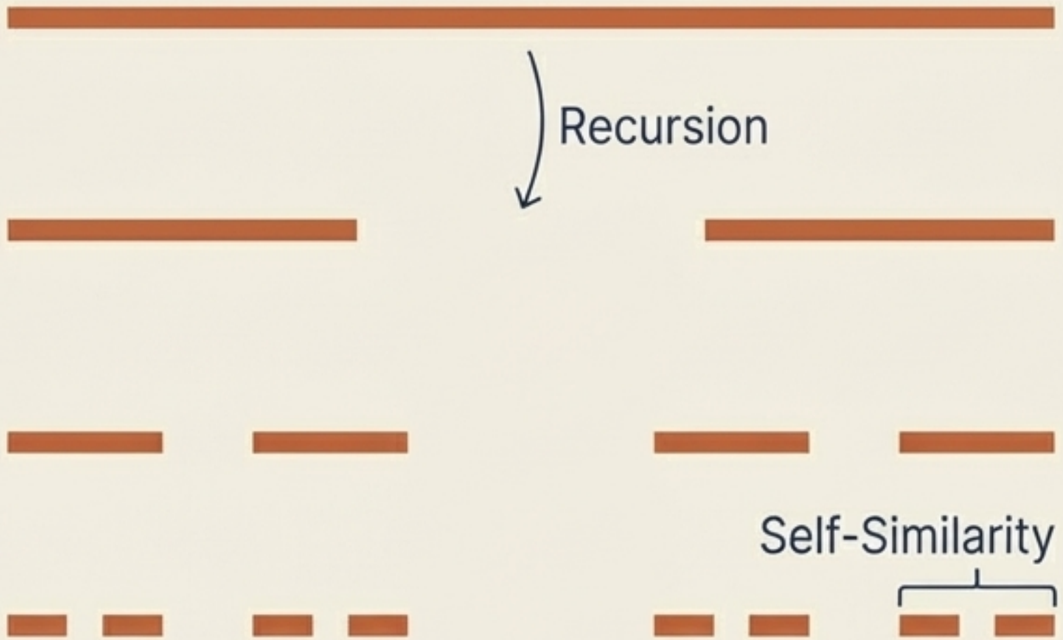
Colonial perspectives often viewed such layouts as lacking conscious design, dismissing them as products of minimum effort or unconscious social forces, similar to urban sprawl.

A New Geometry for an Old World

What is a Fractal?

Fractal geometry describes shapes that are "self-similar"—meaning small parts look like the whole. They are generated through "recursion"—a process where a simple rule is applied repeatedly.

While formalized in the West in the late 19th and 20th centuries, these are not exclusively modern concepts.

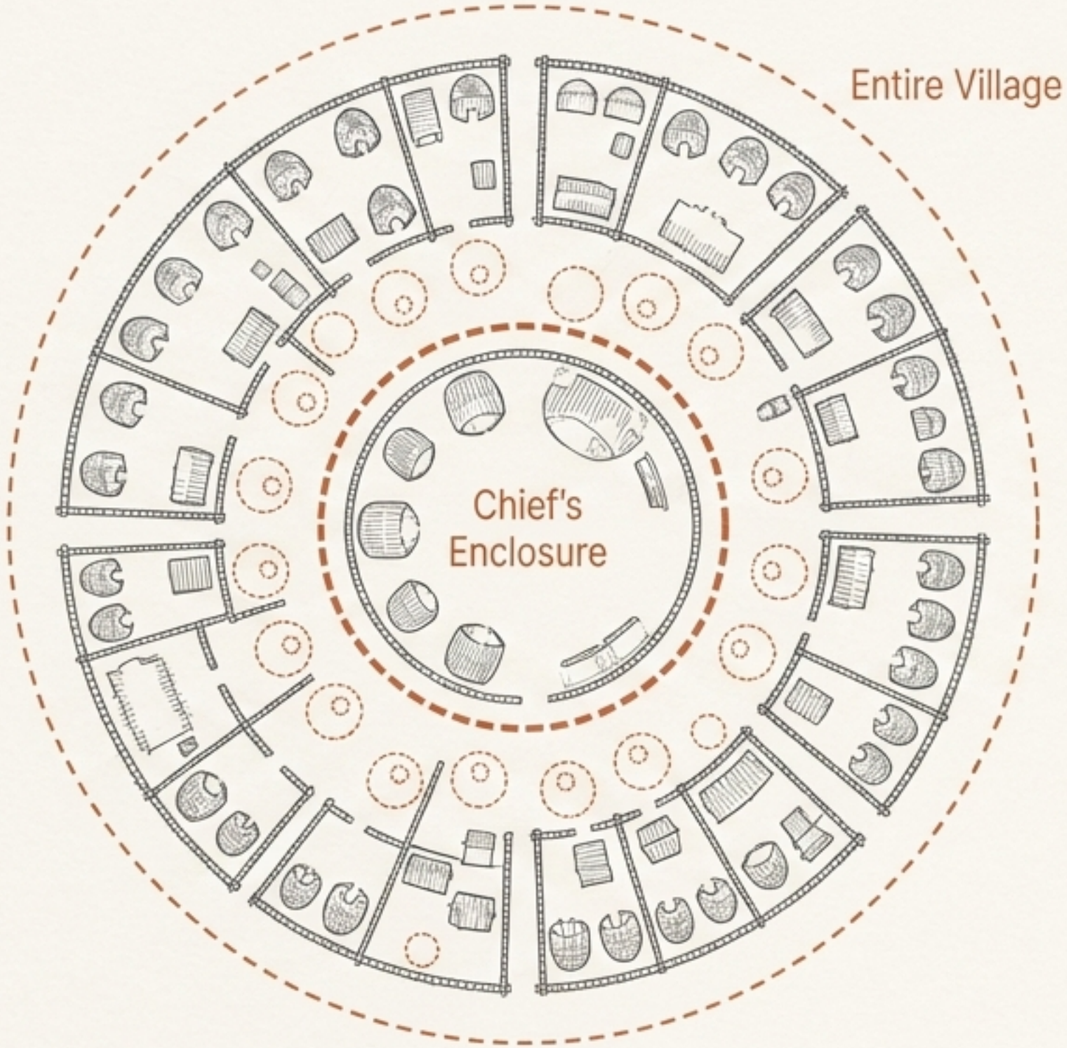


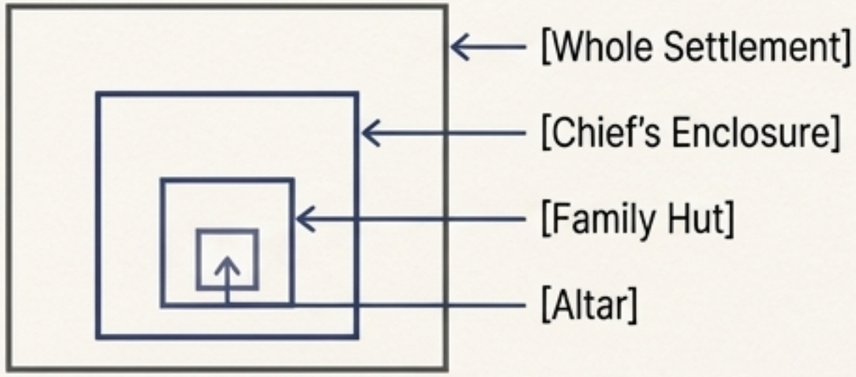
"This challenges the colonial dichotomy between 'modern/scientific' and 'indigenous/primitive' knowledge."

The Groundbreaking Thesis

Ron Eglash's research reveals that fractal geometry is not an accidental byproduct but a conscious, intentional, and foundational element of architecture, art, religion, and social systems across Africa.

An Architecture of Relationships





The **Ba-ila village** is a physical map of their social structure. The chief's enclosure is a miniature version of the entire village.

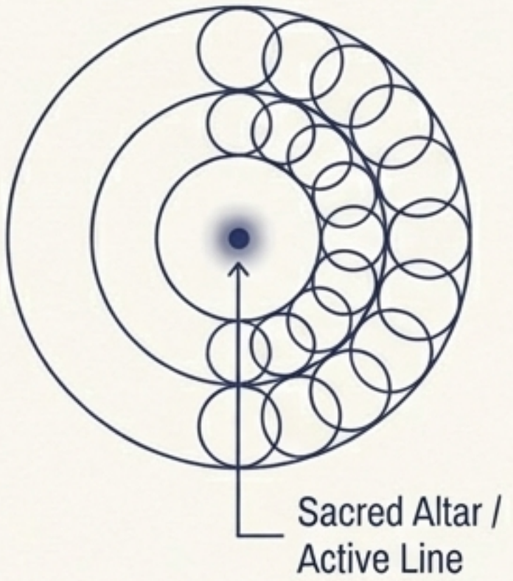
This self-similarity is not just aesthetic; it reflects the concept of *kulela* ('to nurse, to cherish'). The chief's relationship to the community is recursively echoed in the family and spiritual ties at every scale.

"The form of it in the plan is the form of the greater number of Ba-ila villages."

- Edwin Smith & Andrew Dale, 1920

Generated by Rule, Woven with Meaning

Mofou, Cameroon



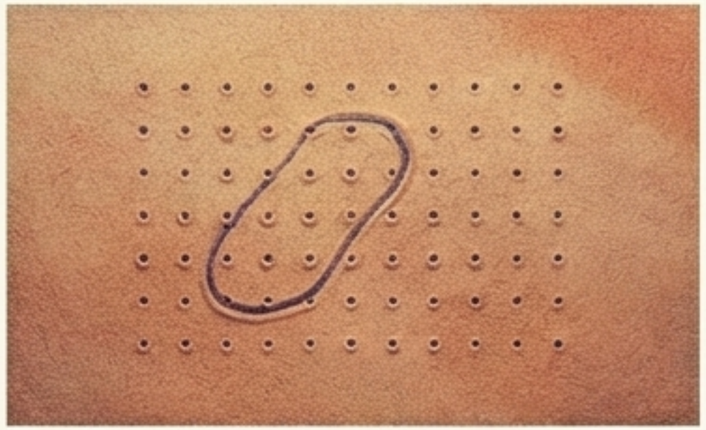
Mofou chiefs explained that architecture begins with a precise knowledge of agricultural yield, which determines the number of granaries. The design is a planned, generative process, not ad-hoc. Their sacred altar acts as a conceptual “active line" for the iterations of life.

Nankani, Ghana

The triangular decorations represent the *zalanga*, a self-similar stack of bowls. The smallest bowl is a shrine for a woman's soul. This connects scaling patterns directly to the concept of eternity, symbolized by a serpent of infinite length.

More Than a Pattern, An Algorithm

1. Draw grid
2. Trace path
3. Repeat



Iteration 1

Iteration 2

Iteration 3

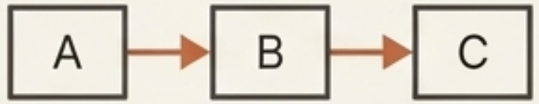
Lusona are not mere pictures; they are the output of a geometric algorithm. Successive iterations of the same rules produce similar patterns of increasing size. This tradition demonstrates a formal, procedural approach to generating complex designs.

A Formal System

Similarly, Mangbetu artisans in the Congo developed a strict 45-degree angle construction technique. By restricting the permissible angles to a small set, they created a formal system that allowed them to better display their geometric ingenuity and compete with other artists.

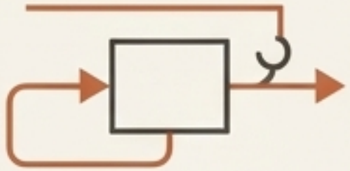
The Logic of Recursion: How Generations Build on Themselves

Cascade Recursion



A pre-determined sequence of similar processes. Limited power as the number of steps must be known in advance.

Tail Recursion



Far more powerful. The process can continue indefinitely until a condition is met. The basis for iteration and growth.

Self-Reference (Reflexive Recursion)

The most complex form, where a system models itself. The basis for concepts of infinity and self-generation.

African design employs all three forms of recursion, often linking them to core cultural themes of lineage, fertility, and cosmology. The recurring motif of “a fish swallowing a fish” symbolizes concepts from good luck in fishing to assertions of power: “just as you have swallowed others, I will swallow you.”

The Decisive Difference: Conscious Design vs. Unplanned Sprawl

Unintentional Fractals: A byproduct of aggregate social dynamics with no overarching design principle. Emerges from minimum effort.

Intentional Fractals: A product of conscious aesthetic and functional choices, based on shared cultural and mathematical principles.

Not all fractals are created equal. The fractal patterns of Western urban sprawl are unintentional byproducts. In contrast, African fractal designs show clear evidence of conscious design criteria. When communities transitioned from circular to rectangular buildings, they made deliberate choices to either maintain or erase the branching, fractal forms. This is not accident; it is ethnomathematics in practice.

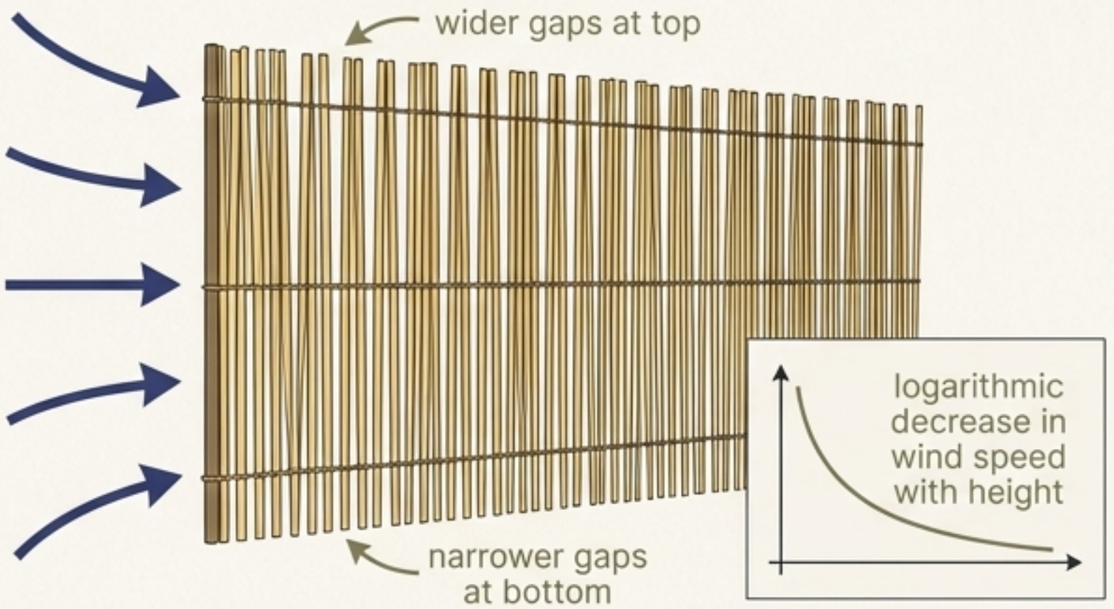
Computing in Parallel: Digital Symbols and Analog Structures

The Arbitrary Symbol

7

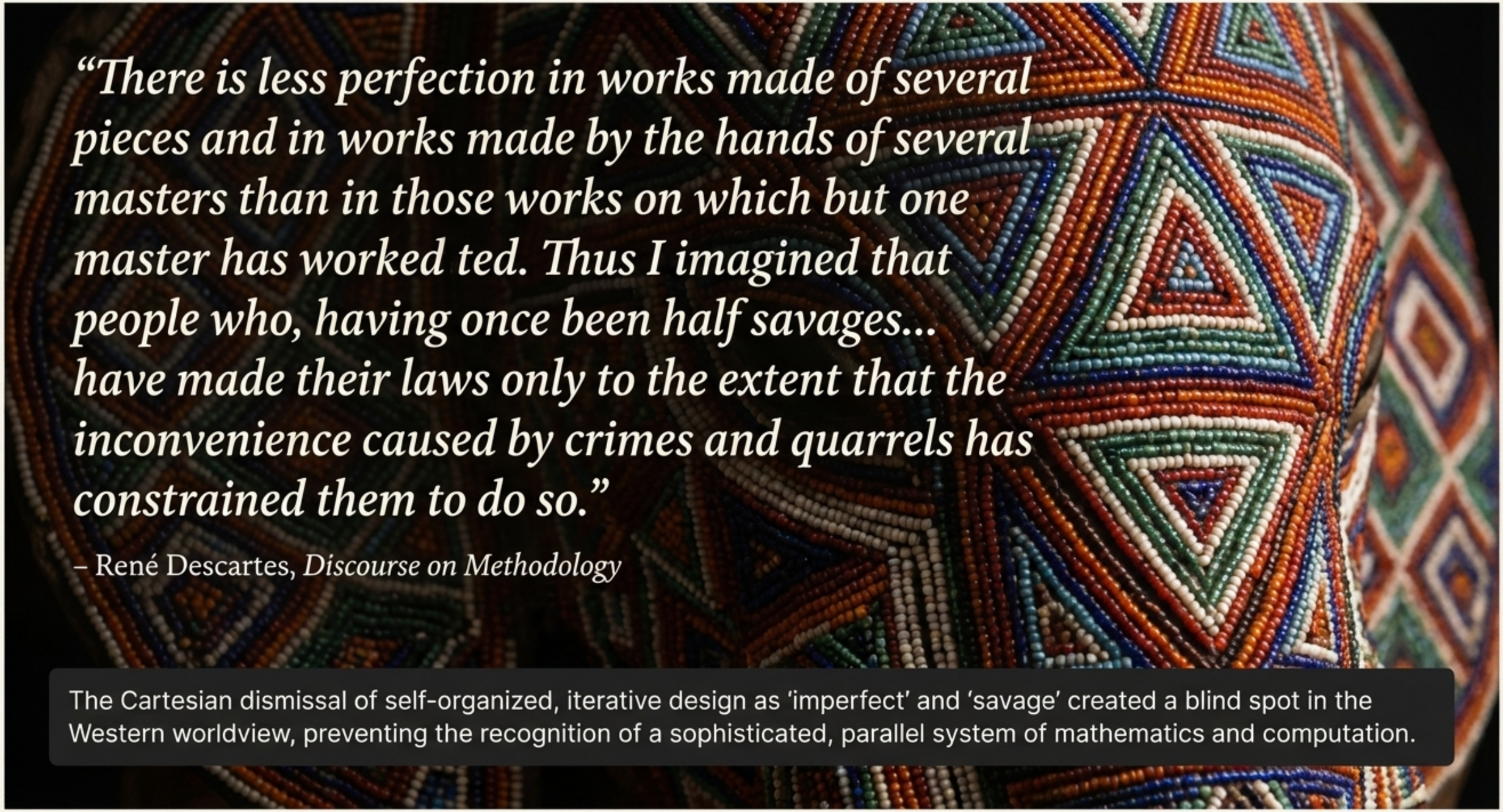
In digital systems, information is represented by arbitrary symbols. As Gregory Bateson noted, “There is nothing ‘sevenish’ about the numeral 7.” This is the foundation of most Western computation.

The Reflective Structure



In analog systems, the physical structure directly reflects the information it processes. Sahelian windscreen makers scale the rows of straw to match the logarithmic decrease in wind speed with height. The fence *is* the calculation.

This reveals a sophisticated application of applied mathematics where the object itself is a form of analog comput



The Cartesian dismissal of self-organized, iterative design as ‘imperfect’ and ‘savage’ created a blind spot in the Western worldview, preventing the recognition of a sophisticated, parallel system of mathematics and computation.

Beyond the Individual Moment: Redefining Intentionality

What counts as ‘intention’? The Western view often focuses on an individual performing a single, immediate action.

An anthropologist studying Ecuadorian mud terraces saw no one actively building them and concluded they were unintentional by-products of farming. He missed the possibility of a long-term, collective project extending over generations.

African fractal architectures and design traditions suggest a different model: intentionality can be collective, distributed, and generational. Knowledge is not just held by an individual genius but is embedded in the community’s iterative practices.

The Complexity at the Edge of Chaos

Pure Order
(Periodic)

Complexity
(Fractal)

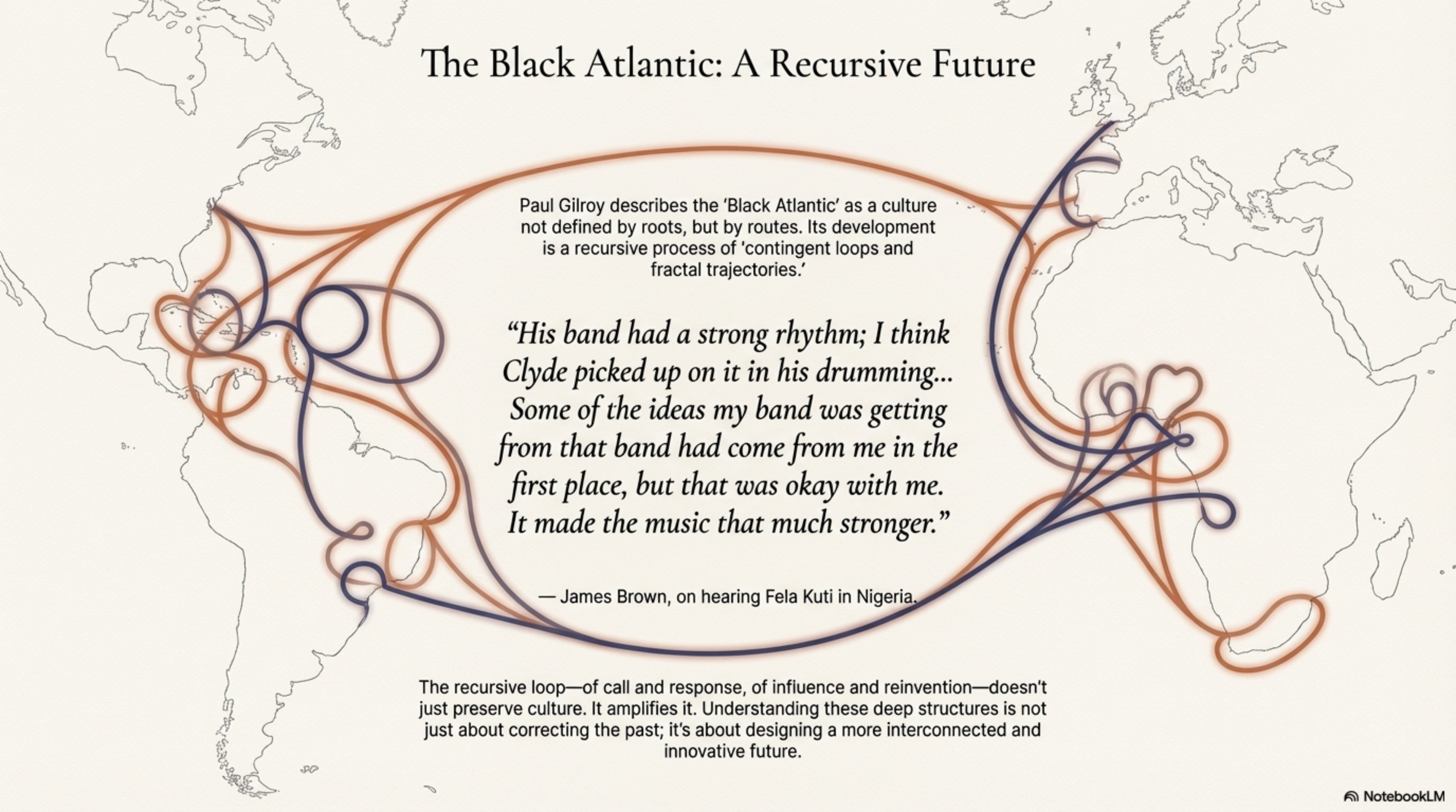
Pure Disorder
(Random)

In modern complexity science, the most complex, adaptive, and self-organizing systems are found “at the edge of chaos,” characterized by fractal patterns and 1/f noise.

Bamana sand divination provides a stunning parallel. Its iterative, recursive process using mod 2 operations is designed to maximize variety and avoid simple repetition, creating a system of “deterministic chaos.”

This embodies a worldview that embraces the connection between determinism and unpredictability—a concept personified by the “trickster” god, who is both rule-bound and unpredictable.

The Black Atlantic: A Recursive Future



Paul Gilroy describes the 'Black Atlantic' as a culture not defined by roots, but by routes. Its development is a recursive process of 'contingent loops and fractal trajectories.'

"His band had a strong rhythm; I think Clyde picked up on it in his drumming... Some of the ideas my band was getting from that band had come from me in the first place, but that was okay with me. It made the music that much stronger."

— James Brown, on hearing Fela Kuti in Nigeria.

The recursive loop—of call and response, of influence and reinvention—doesn't just preserve culture. It amplifies it. Understanding these deep structures is not just about correcting the past; it's about designing a more interconnected and innovative future.