

The Art of Infinity: Fractals in African Culture

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Modern Mathematics: Logic, Probability, and Statistics

Introduction

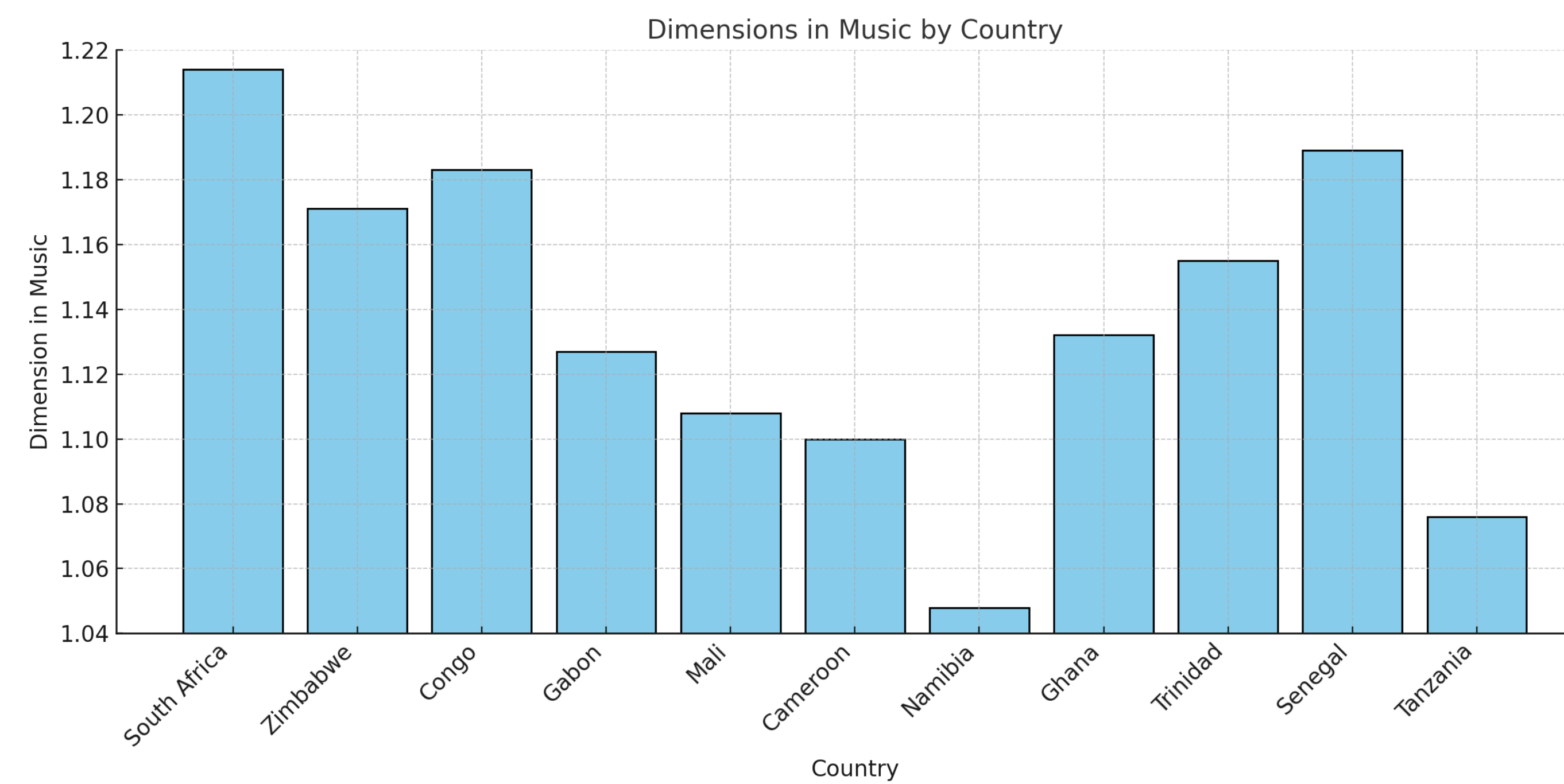
Fractals, geometric shapes exhibiting self-similarity at multiple scales, are deeply intertwined with both natural and cultural phenomena. My research explores the intersection of fractal geometry and African culture, using tools like Hausdorff dimensions to analyze the complexity of traditional rhythms, shapes, and patterns. By uncovering the high fractal dimensions in African culture, my study highlights how the repeating of shapes can actually play into the complex nature of one's culture.

Fractals in Africanist Music?

- In 2012, Reggie Wilson noticed differences between African rhythms and Western musical structures.
 - Hypothesized that fractal geometry could explain the unique complexity of traditional African music
- Using Hausdorff dimensions and Higuchi's method to measure complexity and audio waves, researchers examined African musical samples to determine their fractal properties.
- African music showed high fractal dimensions reflecting complex rhythmic patterns in traditional drumming

Hausdorff Dimension

- A mathematical tool used to measure the complexity or "roughness" of fractals.
 - Unlike traditional dimensions (e.g., 1D, 2D), it can take non-integer values, capturing the intricate, self-similar structures of fractals.
 - Quantifies how a fractal scales as its size changes, providing insight into patterns that cannot be described using classical geometry
- Calculated by analyzing how much space a fractal occupies at progressively smaller scales
- Provides a quantitative way to analyze complex art forms
 - Bridges fields like mathematics, music, and culture to reveal patterns in intricate forms



Fractals in African Art?

Based on the data of fractals in African music, I became curious on if the data corresponded for African art as well. This inspired me to analyze these patterns using the same mathematical tools, exploring how fractal complexity connects a range of forms regarding cultural intricacy. This research aims to deepen our understanding of fractals as a universal language across disciplines.

Ndebele Wall Paintings (South Africa)
Fractal Dimension - 1.4



Tikar Designs (Cameroon)
Fractal Dimension - 1.15



Kasai Velvet (DRC)
Fractal Dimension - 1.25



Mud Cloth (Mali)
Fractal Dimension - 1.3



Rock Art (Namibia)
Fractal Dimension - 1.02



Conclusion

My hypothesis held true as countries with the highest fractal dimension in music, like South Africa, had a higher fractal dimension in art forms as well. Conversely, countries with lower fractal dimensions in music, like Cameroon, had a lower fractal dimension in their respective art form. This correlation highlights the interconnection of cultural expressions, suggesting that fractal complexity is a unifying characteristic across culturally complex domains.

References

Gómez-González, Claudio, Sidhanth Raman, Siddharth Viswanath, and Jesse Wolfson. "Fractals in Africanist Music." *MAA Focus*, vol. 44, no. 4, 2024, pp. 18-22.
Vanderbilt University. "Fractals." Vanderbilt University Department of Psychology and Human Development.