

Research Cluster on Fractals
compiled by Susan Manning
with contributions by Jesse Wolfson
for Reggie Wilson

Fractals became a research cluster for (*project*) *Moseses Project* somewhat later than the other four clusters on Zora Neale Hurston, Ohad Naharin, Zar and Nubia, which had taken shape through Susan's and Reggie's conversations in summer 2011. It was not until February 2012, while doing planning for the research residency in April, that Reggie excitedly told Susan about his discovery of Ron Eglash's book titled *African Fractals: Modern Computing and Indigenous Design*. Eglash's application of "advanced Western" mathematics to "traditional African" design fascinated Reggie on several different levels. First, he wondered if Eglash's thesis, premised on material culture, also held for performance culture. Further, he wondered how Eglash's understanding of fractals might relate to his long-term interests in multiples (myriad Moseses, not a single Moses), tangents (the associative links between Zora, Ohad, Zar and Nubia), accumulations and recursions (compositional devices in Africanist and postmodern dance). Reggie even wondered if Eglash's ideas might not explain the cultural patterns of the African diaspora.

With all these thoughts and questions, Reggie started his research in a pragmatic way and asked Susan if she might find a mathematician he could meet in Chicago to pursue his interest in fractals. In this way Jesse Wolfson, a graduate student in mathematics at Northwestern, became an invaluable resource and collaborator. After meeting Jesse in April 2012, Reggie consulted with him independently, and by the time Reggie and his dancers arrived for the first studio residency two months later, Jesse was ready to present a workshop on fractals to the dancers in the studio. From this point, the question of how movement might be organized according to the principles of fractals was rarely absent from conversation and experimentation in the studio. At the open rehearsal staged at the end of the residency in June 2012, the audience became as compelled—and perhaps as perplexed—about fractals as had the dancers in the studio.

Included on this research website are materials by Eglash explaining his thesis on "African fractals" and by Jesse applying these principles to music.

- Ron Eglash is an "ethnomathematician," that is, a scholar who does not assume that math inhabits a universal realm of abstract truth, but rather seeks to understand the cultural underpinnings of different concepts and conceptions of numeric systems and operations. As he explains in his TED lecture posted on the research website, Western mathematicians did not isolate fractals until the late nineteenth century, and it took another 100 years for Western mathematicians to pursue active research on the topic. In 1975 Benoit Mandelbrot, a French-American of Jewish heritage, coined the term "fractal" to describe self-similar and self-generating patterns often found in nature. Since then, fractals have become an essential part of computer design and digital imaging.

Almost 25 years after Mandelbrot published his treatise, Ron Eglash published his book *African Fractals: Modern Computing and Indigenous Design* (New Brunswick NJ: Rutgers University Press, 1999). There Eglash demonstrated that for centuries African cultures had applied the principles of fractal geometry in building houses and fences, decorating fabrics and pottery. Even African systems of divination reveal fractal patterns. This thesis galvanized Reggie and led him to ask whether African music and dance also embodied fractal patterns, which can unfold in time as well as in space.

In retrospect, it seems unlikely that Ron Eglash would have noticed the connection between African material culture and fractal geometry had not Cheikh Anta Diop, among others, revolutionized the way we understand African culture. Further information on Diop can be found in the research memo on Nubia.

- In the studio, Jesse Wolfson defined fractals as a type of **symmetry**, which he contrasted to other types such as reflection symmetry (two halves of a face, or two dancers mirroring one another's movements), rotational symmetry (a wheel turning), or translational symmetry (the repetition of tiles in a floor pattern). In his powerpoint presentation posted on the research website, Jesse explained how fractal symmetries may be generated through **scaling** or adjusting the spatial size, length in time, loudness/softness, or other variables (called "parameters" by mathematicians) of the pattern. Fractals have helped mathematicians understand dynamic systems, even chaotic systems in nature such as storm systems or whirlpools.

After explaining the basic principles of fractal symmetry in his powerpoint point, Jesse then turned to analyzing African diasporic music, examples of which Reggie had sent him as audio files. Included on the research website are the musical examples and Jesse's analysis of whether the musical patterns might be considered fractal. After listening to the music in the studio, Reggie asked the dancers to vary different movement elements and qualities in an attempt to generate fractal patterns. On subsequent days, he asked the dancers to revisit earlier material and attempt to "fractalize" the patterns—not a term that Jesse used, but a term created by the dancers in the studio. This movement and choreographic investigation is ongoing and will continue in subsequent residencies.

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Interrelating Reggie's investigation of fractals with the other four research clusters for *(project) Moses Project* raises further questions: Are fractal patterns the basis for what Zora Neale Hurston first defined as "characteristics of Negro expression" in 1934 and what later thinkers have called "Africanisms in American Culture"? When Hurston describes "asymmetry" in her 1934 essay, "Characteristics of Negro Expression," is she describing fractals? As Hurston writes,

Asymmetry is a definite feature of Negro art....It is the lack of symmetry which makes Negro dancing so difficult for white dancers to learn. The abrupt and unexpected changes. The frequent change of key and time are evidences of this quality in music....The presence of rhythm and lack of symmetry are paradoxical,

but there you are. Both are present to a marked degree. There is always rhythm, but it is the rhythm of segments. Each unit has a rhythm of its own, but when the whole is assembled it is lacking in symmetry. But easily workable to a Negro who is accustomed to the break in going from one part to another, so that he adjusts himself to the new tempo.

If Zora's description of "asymmetry" indeed describes fractals, then Eglash's thesis may well have wide applicability in studies of the African diaspora. In fact, Paul Gilroy, one of the leading contemporary scholars of the African diaspora, does use the term "fractal" to describe the global circulation of black music and culture. (Dance does not enter his discussion, nor does he undertake an extended definition of fractal symmetry, as Jesse provided Reggie and his dancers.) In a footnote to his widely influential study, *The Black Atlantic: Modernity and Double Consciousness* (1993), Gilroy states:

I am thinking of fractal geometry as an analogy [for cultural circulation in the black Atlantic] because it allows for the possibility that a line of infinite length can enclose a finite area. The opposition between totality and infinity is thus recast in a striking image of the scope for agency in restricted conditions.

Although Gilroy reaches this conclusion independently of Ron Eglash, their arguments seem complementary. Might Reggie's choreography from 1988 until the present be seen as the danced equivalent of Gilroy's "black Atlantic" and Eglash's "African fractals"? Although artists and scholars cast the results of their research in very different formats, they often undertake similar investigations at the same time. Here as elsewhere, Reggie's research uncovers unexpected connections.