Creating Again and Again:
Fractal Patterns and Process in Improvisational African-American Quilts

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An Eye for Fractals

Benoit Mandelbrot, best known as the founder of fractal geometry, described the acclaimed Japanese artist Hokusai Katsushika as having "an extraordinarily refined 'eye for fractals,'" even though Hokusai could not have been aware of the formal mathematical concept of fractals.[1] I do not know if Mandelbrot was familiar with the work of African-American quilters, such as Rosie Lee Tompkins or the quiltmakers of Gee's Bend, Alabama, but I believe he also would have thought that these artists had a very good eye for fractals. Mandelbrot wrote, "For me, the most important instrument of thought is the eye. It sees similarities before a formula has been created to identify them."[2] As a visual artist, I have been fascinated by Afro-traditional[3] quilts for more than 25 years and, in recent years, with fractal geometry. Once I discovered fractals, I began to see the patterns in improvisational African-American quilts with more refined eyes and I began to understand my strong attraction to this art form.

Before exploring the topic of fractal patterns in Afro-traditional quilts, let me begin with a basic definition of a quilt: a quilt is a bedcover composed of at least two layers of fabric, which are joined by ties or stitches. Most typically, a lighter layer, which adds insulation and warmth is included in between. The top layer of the quilt may be a single piece of fabric (this is referred to as a wholecloth quilt), but it is often pieced in a patchwork pattern, the blocks being made individually and assembled into the finished quilt. Quilting traditions exist in many cultures and have been prominent in the United States since colonial times. Initially created for warm bedding, quilts were also made to commemorate births, deaths, weddings, and other important events. In contrast, contemporary quilts are frequently made purely as art objects and may be displayed on the wall, rather than used as bedding. The quilts I focus on in this discussion qualify as contemporary art objects, as well as functional bedcovers.

The quilts considered in this article are from two separate groups that can both be referred to as Afro-traditional: quilts from Gee's Bend, Alabama, and quilts from the collection of quilt scholar Eli Leon. The quilters from the Gee's Bend peninsula, on the Alabama River southwest of Selma, are the descendants of slaves. After the Civil War, these freed slaves remained on the small peninsula and formed an all-black community of about 700, commonly known as Gee's Bend, and officially renamed Boykin. Despite a long history of extreme poverty, generations of women in this community have expressed themselves artistically through quilting and they continue to create new quilts today, even when adequate bedding is readily available. According to curator Alvia Wardlaw, "Few other places can boast the density of Gee's Bend's artistic achievement, which is the result both of geographical isolation and an unusual density of cultural continuity."[4] In addition, we can find in Gee's Bend, surviving quilts created by up to three or four generations of women from the same family, as well as by different lineages within the community.[5]

Figure 1. *Put-together*. Pieced by Rosie Lee Tompkins, Richmond, California (1985). Quilted by Willia Ette Graham, Oakland, California (1986). 74 × 82 inches. Photo by Sharon Risedorph.

Collector Bill Arnett visited Gee's Bend in the 1990s after seeing a photograph from the community, which showed an unusual quilt. Since his first visit to Gee's Bend, he and his family have documented over 700 quilts from the area.[6] By contrast, the African-American quilts collected by Eli Leon are not from a single community, but are chiefly from California, Louisiana, Texas, and Arkansas; they date from roughly the 1930s to the present. Many of the California quilters, whose work Leon has collected, migrated there from the South during the mid 1900s. Leon has also documented multiple generations of quiltmakers within families. With a collection of quilts exceeding 3000 and over 100 hours of interviews, Leon has written extensively on the stylistic connections of these quilts to artistic creations in Africa.[7] The primary inspirations for the ideas presented in this article are Leon's research, as well as that of ethnomathematician Ron Eglash, which concerns the propensity for fractal geometry in African cultures.[8]

Unlike the quilts described in this article, standard or traditional American block quilts are based on Euclidian geometry and are made by both black and white quilters. However, Afro-traditional quilts differ markedly and their structure may at first appear random to some viewers. This was especially true before the quilts of Gee's Bend received widespread recognition and acclaim over the last decade. They are now accepted as remarkable examples of abstract art.[9] Is there an underlying geometry in these Afro-traditional quilts that, when understood, reveals a structure with self-similar components? Does this geometry open our awareness to processes that help unlock the mysteries of these quilts and allow us another layer of appreciation?

African Influences

Since the early 1980s, scholars of Afro-traditional quilts, such as Maude Southwell Wahlman, Eli Leon, and others, have provided a new vocabulary to describe the aesthetic preferences of Afro-traditional quilters, which include strip-construction, multiple patterning, flexible patterning, asymmetry, bold patterning, and improvisation.[10] While one or more of these characteristics may dominate in a particular quilt, improvisation, or variation on a theme, is especially prevalent. Improvisation is widely acknowledged to be a core component and aesthetic impetus of African and African-American art forms. In fact, folklorist John Michael Vlach referred to improvisation as "the basis of Afro-American creativity," and said that in both African textiles and African-American quilts, "there is a use of formal design motifs but not a submission to them. There is a playful assertion of creativity and innovation over the redundancies of disciplined order."[11]

The view that there is a definable African-American style of quilting is a highly charged and controversial topic. Prominent quilt researchers, such as Shelly Zegart[12] and Cuesta Benberry,[13] have rightly cautioned about over-simplifying the homogeneity of an African-American quilt style or the direct correlation between present-day African-American quilts and African textiles. African-Americans make quilts of all types and their contributions to American quiltmaking cover many categories. The improvisational quilts discussed in this article constitute only a portion of the wide range of styles produced by African-Americans. And most assuredly, to say that a certain style is carried on in the cultural practices or preferences of a location and community is not to say that it is genetic. Honoring the distinct and rich qualities of a culture is not the same as stereotyping.

One point presented by opponents of this classification is that such quilts do not necessarily

Figure 2. *Three Sixes*. Pieced by Rosie Lee Tompkins, Richmond, California (1987). Quilted by Willia Ette Graham and Johnnie Wade, Oakland, California (1996). 77 × 98 inches. Photo by Sharon Risedorph.

represent the majority of quilts made by African-Americans. However, this truth does not negate the possibility that the working methods or aesthetic preferences of some groups or individuals have been passed down from their origins in Africa through generations of quilters, and have been retained in contemporary practices. A comparison might be drawn to jazz, blues, and rap: African-Americans practice multiple musical styles from many cultures, but few would deny that jazz, blues, and rap have African and African-American origins. Eglash explains the value of exploring possible African antecedents in contemporary African-American culture:

> African Americans suffered not only the trauma of slavery, but also a severing of cultural ties unlike any other US minority. The rare cases in which some aspect of African culture was transmitted—musical traditions like blues and jazz; adornment styles like cornrows, etc.—are both precious and profound.[14]

Denying the possibility of African antecedents to this art form is as dangerous as overstating those connections. In the case of the community of Gee's Bend, these quilters were descendants of slaves who created an all-black community and were almost entirely isolated from the broader American culture. Indeed, it would be difficult to make a case that the culture of Gee's Bend does not in some way reflect the African past of its ancestors. Eglash describes fractals as a design practice that is widely shared throughout Africa, one that is expressed in many different forms.[15] If fractal design preference exists in the improvisational African-American quilts, it would likely be expressed in methodology, rather than direct visual imitation.

In the introduction to *Who'd A Thought It: Improvisation in African-American Quiltmaking*, by Eli Leon, art historian Robert Farris Thompson states that the parallels to African textiles described by Leon are not "direct inheritances," but influences that were fragmentarily brought to American shores.[16] American literary critic and scholar, Henry Louis Gates, writes about the tradition known as "signifying" in the oral traditions of both Africans and African-Americans. He asserts:

> Signifyin(g) in jazz performances and in the play of black language games is a mode of formal revision […] most crucially, it turns on repetition of formal structures and their differences. Learning how to Signify is often part of our adolescent education.[17]

Gates' thesis is that Signifying is a pervasive aesthetic that underlies many African-American art forms. My hypothesis is that the process described by Gates informs the improvisational process at work in African-American quilts as well, and that this can lead to the formation of fractal patterns in the quilts.

This article explores the evidence of fractal patterns in both the visual design and the underlying creative process of certain improvisational Afro-traditional quilts. To the untutored Western eye, the designs of these Afro-traditional quilters may seem unstructured. However, I suggest that fractal geometry underlies the structure and process of these quilts, just as surely as Euclidian geometry underlies the structure and process of the standard American quilts that follow a precise block pattern. The following questions will be explored as a way of seeing the underlying design geometry of these Afro-traditional quilts: Does the process of improvising create a fertile ground

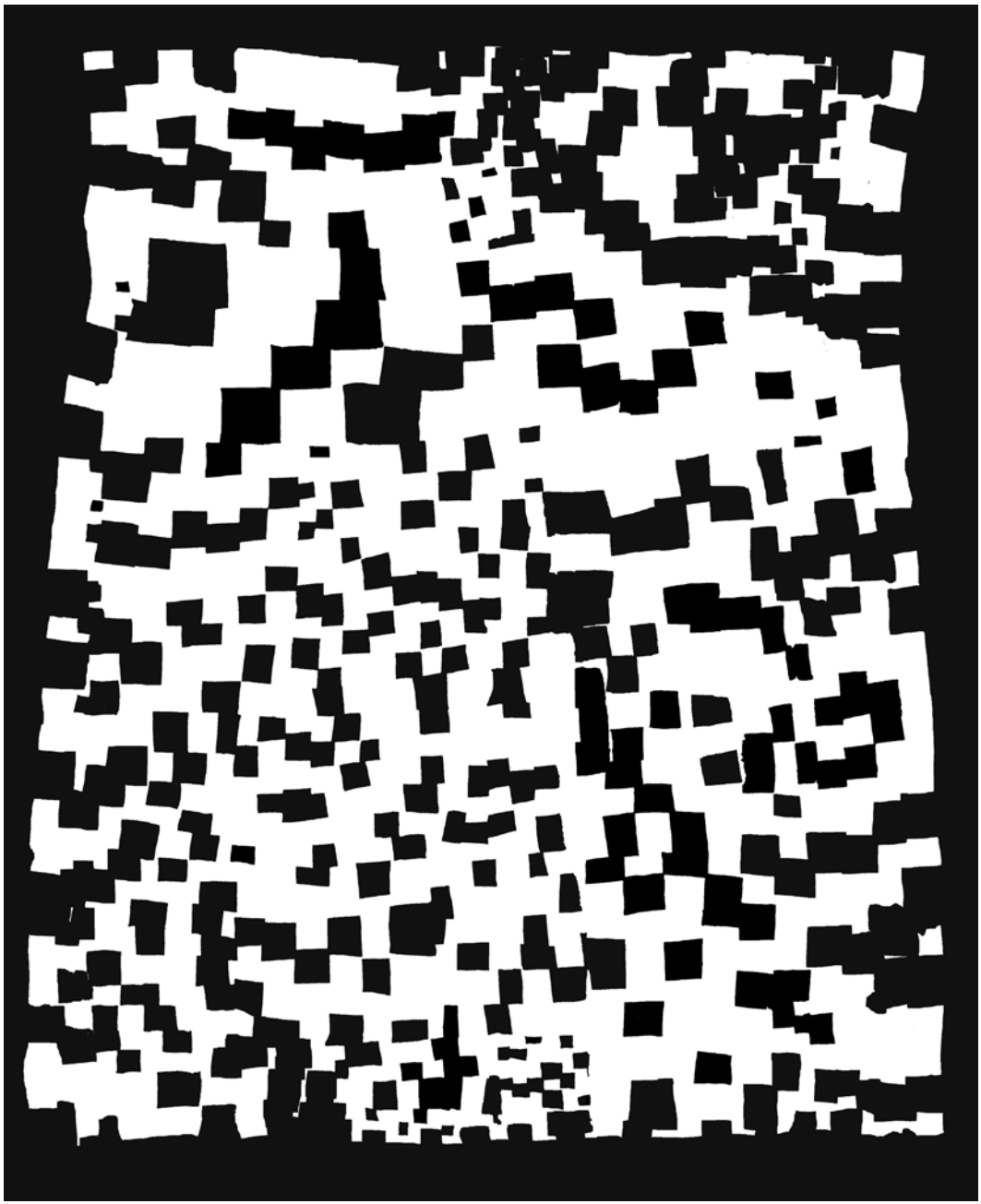

Figure 3. *Three Sixes*. Converted to black and white image. Pieced by Rosie Lee Tompkins, Richmond, California (1987). Quilted by Willia Ette Graham and Johnnie Wade, Oakland, California (1996). 77 × 98 inches. Photo by Sharon Risedorph.

Figure 4. *Restructured Strip.* Pieced by Angie Tobias, Merced, California. Quilted by Irene Bankhead, Oakland, California. ca. 1987. Dimensions unknown. Photos by Eli Leon.

for fractal patterns to be created? Is improvisation also related to the field of mathematics known as deterministic chaos (or complexity), which is involved with the creation of fractal patterns?

This discussion will explore how many Afro-traditional quilters follow an intuitive, but systematic, process that creates fractal patterns through innovation and improvisation. In his book *African Fractals: Modern Computing and Indigenous Design*, Eglash discusses three ways that fractals are formed. The first is unconscious, as in urban sprawl, when a pattern unfolds through no conscious intent of the makers. The second is intentional, but implicit: the maker is not using mathematical calculations, but feels that the patterns "look right." The third is an activity wherein formulas are consciously used to create patterns.

The analysis in this article will show how African-American quilters, through innovation and improvisation, follow an intuitive and non-formulaic process to create fractal patterns. This is not meant to imply that all Afro-traditional quilts contain fractal patterns, but to suggest that a propensity for fractal patterns may be one characteristic that frequently appears.

Fractals in Nature and the Nature of Fractals

The general public has increasingly become familiar with and started to understand fractal geometry, since Mandelbrot gave it its name in 1975. Once tuned into fractal geometry, one begins to identify it throughout the natural world. Nature is comprised not of pure circles, rectangles, and triangles, but of shapes that are wrinkly, crinkly, billowy, thorny, or otherwise rough. "Rough" means irregular, as opposed to the smooth, perfect shapes of Euclidian geometry. According to Mandelbrot, the study of fractals

Figure 5. *Medallion*. Pieced by Laverne Brackens, Fairfield, Texas. Quilted by Irene Bankhead, Oakland, California. 1992. Dimensions unknown. Photo by Sharon Risedorph.

opened up "roughness for investigation."[18] Knowledge of fractals allows scientists to measure irregular shapes, such as a coastline, a cloud, or a mountain range, with the same precision that an architect might measure a building. It extends classical geometry, deepening its power. With computer technology, fractal geometry can create precise representations of any form in nature, a feat we witness every time we go to a movie that uses computer-generated landscapes.[19]

In his introduction to *Fractals Everywhere*, Michael Barnsley says,

> There is danger in reading further. You risk the loss of your childhood vision of clouds, forests, galaxies, leaves, feathers, flowers, rocks, mountains, torrents of water, carpets, bricks and much else besides. Never again will your interpretation of these things be quite the same.[20]

It is true. I now see fractal patterns everywhere, which enhances both my innocent childhood eye and my artistic adult eye. I also see fractal pattern-making, sometimes intentional, sometimes intuitive, in the processes evident in much contemporary visual art. And I cannot help but notice processes that produce fractal patterns all around me. For instance, as I watch milk coming to a boil in a pan, bubbles form and start rising and increasing in size until, if unchecked, they expand over the edge of the pan. These roughly spherical bubbles range from small to large and this fractal scaling is the product of a process: the transition of the milk from cold to boiling.

I am not a mathematician, but, as an artist, I found that only understanding some basic concepts of fractal geometry enabled me to perceive fractal characteristics in the quilts of the aforementioned improvisational quiltmakers. As the quilts are discussed, it is good to keep in mind the essential components of fractals:

Recursion: The driving force of fractals; a circular process, where the output of one stage becomes the input of the next. This simple process can produce very complex results.[21]

Scaling: Fractals are characterized by patterns that repeat themselves, or approximations of themselves, at many different scales.[22]

Self-similarity: Fractal patterns "look the same from close by or far away."[23] Put another way, a small section enlarged will look much like the whole and the entire pattern reduced will look similar to a part. The continued process of scaling, at least in theory, goes to infinity.[24] Rather than mirror symmetry, this symmetry refers to the part reflecting the whole. Mandelbrot points out that, while a mirror reflects an exact image, two mirrors lined up reflect the same image at smaller and smaller scales into infinity.[25]

Infinity: This concept is perplexing, even for mathematicians[26] (or, perhaps, especially so), but it is an accepted part of spiritual traditions worldwide. Of course, for any physical object, the process of recursion cannot actually go to infinity, but can occur only within a certain practical range of scales.[27] In the case of quilting, there are physical limitations as to how small a piece of fabric can be sewed or how large the

Figure 6. *Medallion.* Pieced by Laverne Brackens, Fairfield, Texas (2004). Quilted by Irene Bankhead, Oakland, California. 79 × 76 inches. Photo by Sharon Risedorph.

outer boundaries can be for it to still function as a quilt.

Fractal dimension: Distinct from the one-dimensional line or two-dimensional plane, fractals are somewhere in between. Fractal dimension is the degree of difference between a straight line and a line so rough that it starts to fill in a two-dimensional plane. This difference can be expressed as a fraction, which denotes the degree of change between the dimensions: i.e. 1.2, 1.5, 1.85, and so on.[28]

How does this relate to quilt patterns? Figure 3 shows *Three Sixes*, by Rosie Lee Tompkins, converted into a simple black and white image (the actual quilt is shown in Figure 2). Without the variations produced by color and tone, we can clearly see how the pattern fills the space. We can imagine that, if the quilter continued to make the pattern more and more complex, it would finally fill up the rectangular boundary of the quilt, creating something closer to a two-dimensional plane. Fractal dimension can be determined by several methods. One of the simplest is referred to as the box-counting method. In it, one covers the image with a grid of squares and counts the number of squares that the pattern passes through. This is repeated with grids of smaller and smaller squares. The fractal dimension is determined by the rate at which the proportion of filled squares decreases. The aforementioned pattern has a fractal dimension of about 1.82.

Observers have noticed some of the above components in Afro-traditional quilts, without identifying them as being characteristic of fractals. Although, to my knowledge, no researcher has made direct reference to fractal characteristics in the quilts (with the exception of the following quote by Lawrence Rinder), I frequently find language that might describe fractals and brings to mind Mandelbrot's statement that the eye "sees similarities before a formula has been created to identify them."[29] In Gee's *Bend: The Architecture of the Quilt*, Arnett describes the visual and literal relationship of the quilts to architecture, but he also writes, "Nearly any detail of a Mary Lee Bendolph quilt would work as a quilt unto itself."[30] Arnett later points out a kind of inherent scaling in the format of quilts, especially those of Gee's Bend quilters, who lean toward rectangles within rectangles in their compositions: "Quilt compositions based on the rectangle or square immediately create a mirroring resonance between the object as a whole—the edges—and its constituent elements."[31] This concept is similar to Mandelbrot's description of infinite repetitions of two parallel mirrors. In "Greatness Near at Hand," curator Lawrence Rinder focuses on parallels between Rosie Lee Tompkins' work and the expressive qualities of many twentieth-century abstract painters. With regard to Tompkins' quilts, he says,

> As art, these quilts cohere by the slimmest of margins; they jumble and burst and seem to try to twist from our grasp. Yet, finally they do cohere; *as in fractal geometry*, small bits of her compositions echo and sustain the intensity of the overall design.[32] [emphasis mine]

The squirming shapes of *Put-together*, by Rosie Lee Tompkins, illustrate this point (Figure 1).

Improvisation: Patterns on the Move

An understanding of fractal geometry brings with it an intuitive sense of connection with improvisation. How might the tendency to

Figure 7. *Strips and Strings* Mary Lee Bendolph, Gee's Bend, Alabama. 2003. 74 × 49 inches. Photo by Stephen Pitkin.

improvise be an actuation of recursion and the repetition of design elements at different scales? A comparison between standard quilts, which follow a block pattern, and improvisational quilts, which deviate from such a pattern, helps in analyzing the relationship between improvisation and the tendency to create fractal patterns.

In standard block quilting, a primary goal is to maintain the consistency of the pattern. Even in the scrap quilt, constructed of leftover fabrics, the scraps are pieced together in such a way that like colors or shapes combine to maintain the appearance of the chosen block pattern.[33] We see this adherence to regularity in our Western constructed environment, where we are constantly fighting the roughness or irregularity that Mandelbrot describes as fractal. We square up dwellings, sand, and smooth surfaces, and otherwise attempt to maintain consistency.[34] The precise repetition of a block pattern in the making of a quilt relates to this process of maintaining smoothness or regularity.

Now consider an improvisational quilter starting to piece scraps together based on a block pattern. This quilter is not committed to maintaining that exact pattern and, instead, welcomes the unexpected or unplanned. As the quilter pieces and then trims the fabric, additional and smaller shapes are produced. Being improvisational, he or she is likely to consider these as new elements and incorporate them into a composition that will then be added to the quilt. This process is repeated as shapes continue to be pieced for the quilt. Just as fractal patterns can theoretically continue into infinity, this process could continue infinitely, except for the physical limitations imposed by the quilt.

In *Three Sixes*, by Rosie Lee Tompkins, one can imagine the quilter continually working the smaller pieces produced by her process, back into the composition until they become too small to sew (Figure 2). To experience this process, one can create a paper collage based on a quilt pattern and then continually work the leftover pieces of paper back into the composition. Patterns will unfold in a range of configurations similar to the quilts illustrated, if one is remindful of Mandelbrot's advice to think not only of what we see, but what it took to get there.[35] Emulating this creative process will produce the experience of seeing patterns recursively unfold.

During a conversation I had with quilter Angie Tobias of Merced, California, this process of recursion was further illuminated. In describing her method, Tobias said she makes long quilt-strips, then cuts them up and re-sews them, repeating this process perhaps three to four times. She likes to use small pieces, such as ends from textile factories, because she can make more shapes that way. Figure 4 shows her procedure. On the left side, Tobias is holding a quilt in progress. She subsequently cut the lower portion in two, sewing part of it to the other side. The completed quilt is shown on the right. Again, this process could continue in as many iterations as the quilter desires, as long as the pieces of fabric can be sewed. Tobias says she really never throws fabric away. Sometimes she uses pieces that are as small as 0.5 inch. And whatever is left over from one quilt, she always works into another quilt.

Tobias' comments further suggest that recursion takes place not only within one quilt, but also through a series of quilts by one maker. Mary Lee Bendolph of Gee's Bend created two versions of her piece *Strings and Strips*: one was created in 2003 (Figure 7) and another was completed in 2005 (Figure 8). The latter quilt seems to utilize scraps from the earlier one and elaborates on the earlier patterns.

Improvisational quilters, like improvisational musicians, make a creative decision at each step

Figure 8. *Strips and Strings* Mary Lee Bendolph, Gee's Bend, Alabama. 2005. 81 × 78 inches. Photo by Stephen Pitkin.

of the process. When the quilter completes one step, it is as if their mind floats on the plane of possibilities, if only momentarily, while they decide which way to go with the design. That moment contains the seed of creativity and the pattern may move in any direction—even toward infinity (smaller and smaller patterns moving toward the smallest). The quilter can move the pattern "horizontally," meaning that the design changes, but generally at the same scale, or "vertically," meaning that the scale tends to get larger or smaller. This decision yields a 50/50 chance of fractal scaling. Since the leftover fabric pieces naturally keep getting smaller, this may weight the probability more toward vertical improvisation, although, of course, the quilter may bring other fabric pieces into the process. For these quilters, independent and confident in their own creativity, when the moment of infinite possibilities presents itself, they embrace it and choose to either elaborate on or deviate from their previous step.

Interestingly, Leon concludes that, for these quilters, improvisation, rather than a conscious goal, is the result "of underlying values that favor variation, the unexpected, the unique, the personal."[36] The process of improvisation could not happen without the quilters having strong confidence in their own design sense. Curator Jane Livingston writes, "Studying the quilts of this small community called Gee's Bend, one quickly realizes that they embody a strangely independent, or self-referring, aesthetic."[37] To be self-referring, one must first have a sense of self. When asked about their process, the quilters from Gee's Bend and those interviewed by Leon typically insist that they do not want to use a pattern out of a book, they do not want to make the same quilt twice, and they want to make their quilts "their own." Quilter Sherry Byrd of Richmond, California, says,

> I don't like to use patterns. I think more so they're a waste of my time because it's other people's ideas and not that I don't use other people's ideas, but, you know, I don't like to do the same things over and over, and so I just kind of build my own quilts as I sit at the machine.[38]

In works by quilters such as these, surely the probability for fractal patterns is very high.

While Arnett refers to the "inherent scaling" in these quilts, and Rinder points out that for all their jumbling and twisting the pieces of these quilts do cohere as in fractal geometry, Leon asserts that approximate, rather than exact, measuring is basic to improvisation.[39] He found that most of the Afro-traditional quilters he interviewed did not measure and many recounted that their mothers and grandmothers pieced quilts from designs in their heads, without measuring. When asked if her mother measured, Angie Tobias said, "I don't think so. I think she mostly just make everything by what she feel." Tobias went on to describe her own process: "I just cut 'em. Just long as they look right, I'll fit 'em. I just see that it'll fit in a certain design an' just make it t'fit."[40] Again, this description of her process suggests scaling, which is a basic component of fractal geometry.

The quilter's preference for approximate measuring opens their patterning to a subtle aspect of fractal scaling called affine transformation, which refers to the moving, stretching, and rotating of shapes as if they were on a rubber sheet that was being pulled from opposite corners. An example in nature can be seen in tree bark: one part may look like another part that has not only changed scale, but has been rotated, stretched and compressed, or expanded.[41] The very nature of cloth seems to lend itself to this type of transformation. On the one hand, quilters in the standard American tradition, who are following

Figure 9. *Housetop Medallion*. Louisiana P. Bendolph, formerly of Gee's Bend, Alabama. 2003. 77 × 73 inches. Photo by Stephen Pitkin.

block patterns with Euclidian straight lines and right angles, go to great lengths to offset the stretching or irregularities common to fabric pieces by precise measuring and cutting, blocking, or other means of controlling. On the other hand, improvisational Afro-traditional quilters do not seem to mind the tendency of fabric to change shape, they are happy to take an irregularly shaped piece of fabric and just work it in, or they may purposefully bend geometric shapes.

This propensity is demonstrated in *Put-together*, by Rosie Lee Tompkins (Figure 1). These shapes could be viewed as squares or rectangles that have been stretched and rotated, which brings to mind the characteristic of intonation in jazz and blues, in which the musician slurs and bends notes. Even the exterior rectangular shape of the quilt appears bent in a fashion similar to the parts, mirroring them and creating cohesion through the echoing of shapes. Think again of the aspect of fractal geometry called self-similarity: the tendency for a small section to resemble the whole and the entire pattern to resemble a part.

Patterns of Change: Between Order and Chaos

The gradual changing of a quilt pattern due to small or large adjustments that are based on individual preferences could be compared to the field of math called deterministic chaos, or complexity, which is related to fractals. Fractal scaling exists not only in growth patterns, such as the way tree branches look very much like smaller versions of the whole tree, but it also shows up in images that are created as visualizations of dynamical systems.[42] Dynamical systems involve mathematical rules that locate a point in relationship to its time-value, such as describing the movement of a pendulum. Dynamical systems are extremely sensitive to even minute changes in their initial conditions. Positive feedback is the term for things that cause a system to move toward chaos, like a driver veering off the road. Negative feedback keeps the system moving in an orderly fashion: the driver compensates and steers back onto the road, but never with exactly the same movement or to precisely the same place.[43] In this context, the words positive and negative should not be confused with their typical conversational meanings. This very same phenomenon ensures that, even in the case of twins with identical DNA, cells will still connect in different patterns, so that "identical" twins are still each unique.[44]

The weather is another example of a dynamical system. For many years, scientists believed that the weather and related phenomena could be predicted more accurately with the help of more data. It is now understood that such systems are, for practical purposes, infinitely complex, with elements that are so sensitive to even the smallest influences that it is not possible to predict exactly what they will do at any given time. Although these systems are deterministic, meaning that initial conditions should allow for prediction, influences and random elements make exact prediction impossible. Hence, the weather is always an educated guess. Meteorologists do a pretty good job of giving us short-term forecasts, but their predictions prove unreliable for more than a day or two into the future. Even the smallest change in the conditions of distant weather systems can affect the local system and their effects can reverberate throughout the entire weather system.[45]

Similarly, we can never predict the exact outcome of the process of improvisation. If we look at the creation of a quilt as a system, we can again compare standard quilting methods with those of the improvisational quilter. The practice of standard block quilting demands that the system remains stable. A pattern is chosen and, if

Figure 10. *Housetop Medallion.* Louisiana P. Bendolph, formerly of Gee's Bend, Alabama. 2006. 80 × 72 inches. Photo by Stephen Pitkin.

the quiltmaker cuts precisely and sews according to a predetermined method, the resulting quilt will be predictable, with allowances for variations resulting from choices of color and fabric pattern. This process does not allow the system to change, nor does it allow the designs to morph into shapes that were not mapped out by the pattern. The improvisational quilter approaches the process differently from the beginning. For instance, an improvisational quilter might start with the idea of piecing a medallion quilt, which contains a large central motif and, typically, multiple borders or blocks that surround and repeat elements of the central image. Improvisational quilters are exposed to an almost infinite amount of positive feedback as they work—colors, textures, shapes, patterns of scraps—that could entice the artist to veer from the original concept. Because these quilters are following an improvisational mode, they welcome and embrace this feedback, sometimes playing broadly within the medallion motif, but not departing from the concept of the medallion altogether. So, the quilter juggles positive feedback, creating variation in the pattern, with negative feedback, which maintains consistency in the pattern.

Here are two variations on the medallion theme by Laverne Brackens of Fairfield, Texas. Figure 5 contains small rectangles that form the central medallion and larger rectangles that scale toward the outside edges of the quilt. As you can see, Figure 6 is also a medallion, but it has few similarities to the former, other than basic concept. In the latter piece, large blocks of fabric surround the central motif, which is constructed of triangular shapes. Louisiana Bendolph makes quilts that are called Housetops, but could also be referred to as medallions (Figures 9, 10). Bendolph, much like Angie Tobias, says that she looks at a quilt in progress, and if she does not like it, she cuts it up and redesigns it.[46] While maintaining a tether to the original idea, the improvisational quilter responds with great sensitivity to the seemingly infinite positive and negative feedback that occurs through their process. Willie Mae Chatman of Berkeley, California, describes her work this way:

> Somethin' else will come to your mind, as you go on. I first sit down and think my design out the way I want to make it. I got some [of the squares] a little bit smaller and some a little bit larger [but] after I kept going on and on, well it look like it's goin' turn out alright, so I just kept goin' on.[47]

One can look at hundreds of quilts by Afro-traditional quilters from the Gee's Bend community, those collected by Leon, and other collections, and find startling variation within the structure of patterns such as Bow-tie, Blazing Star, and Nine Patch. In Gee's Bend, favored patterns, such as Housetop, Log Cabin, or Bars and Blocks, have been created within the same group of quilters for years, with astonishing originality, and without repetition. According to Mary Lee Bendolph:

> I see the barn, and I get an idea to make a quilt. I can walk outside and look around in the yard and see ideas all around the front and the back of my house. Then, sitting down looking at a quilt, I get another idea from the quilt I already made.[48]

Engaged in a self-referring process, Bendolph is clearly taking inspiration, which we could call feedback, from her entire physical world, including her own quilts. In some cases, the

most accomplished improvisational quilters seem to teeter on the very edge of moving the quilt's "system" into complete chaos, only to pull it back from that brink by reconnecting with the theme or themes of the work. Rosie Lee Tompkins' *Put-together* is an example of such a feat: a quilt impossible to analyze in its wild energy, but continually engaging, stimulating, and unified (Figure 1).

Many standard quilts exhibit scaling of their geometric shapes. However, creating a quilt from a predetermined pattern, even if that pattern is fractal, does not constitute a conscious fractal process on the part of the maker. This also holds true if a studio quilter creates a quilt from a picture of a fractal, such as an image of patterns from the Mandelbrot Set, which was created with computer software. This would constitute a depiction of a fractal, but not an instance of the fractal process in use by the artist. The quilter who simply depicts is not making design decisions at every step, as is the improvisational quilter. In a predetermined pattern there is, by definition, no encouragement for change from one phase to the next. This does not rule out much variation in color and arrangement of standard patterns, but the primary idea for the standard block quilt is to maintain the pre-defined pattern.

The exploration of chaos theory and dynamical systems gives us a new way of seeing how the creative process unfolds in these quilts. It is possible that this way of working has its roots in Africa. All we know for sure from interviews with the artists, is that these quilters learned their methods from their mothers, aunts, and grandmothers, in a recursive lineage. From these improvisational processes comes the visually beautiful fractal quality of these quilts.

Conclusion

These complex and improvisational African-American or Afro-traditional quilts continue to inspire new ideas and insights by quilt scholars, art critics, curators, and others. It is an indication of their importance in the world of art, in African and African-American history, and in global history. Numerous contemporary quilters, painters, and collage artists cite the work of Gee's Bend and other Afro-traditional quilters as among the influences that inform their work. A look through contemporary art publications shows that the influence of improvisational quilts permeates deeply into the contemporary art world. Fractal geometry serves as a means to describe the mechanics of the design process, as well as being an exquisite metaphor for the visual appearance of the work itself. The result is a deepening appreciation of the marriage of the creative process to universal concepts of mathematics. Most important, this knowledge reminds us to not forget to look.

Notes

1 Benoit B. Mandelbrot, *Fractals and Chaos: The Mandelbrot Set and Beyond* (New York: Springer, 2004), 147.

2 Benoit B. Mandelbrot quoted in John Briggs, *Fractals: The Patterns of Chaos* (New York: Touchstone, 1992), 71.

3 Eli Leon, *Accidentally on Purpose: The Aesthetic Management of Irregularities in African Textiles and African-American Quilts* (Davenport, Iowa: Figge Art Museum, 2006), 37. In it, Leon explains the terms "Afro-traditional" and "standard-traditional," which he defined.

4 Alvia Wardlaw, introduction to *The Quilts of Gee's Bend*, eds John Beardsley, William Arnett, Paul Arnett and Jane Livingston (Atlanta: Tinwood Books, 2002), 8.

5 *Ibid.*

6 *Ibid.*

7 Leon, *Accidentally on Purpose*. See also Eli Leon, *Who'd a Thought It: Improvisation in African-American Quiltmaking* (San Francisco: San Francisco Craft and Folk Art Museum, 1987).

8 Ron Eglash, *African Fractals: Modern Computing and Indigenous Design* (New Brunswick, New Jersey: Rutgers University Press, 2002).

9 Paul Arnett and Eugene W. Metcalf Jr., eds, Mary Lee Bendolph, *Gee's Bend Quilts, and Beyond* (Atlanta: Tinwood Books; Austin: Austin Museum of Art, 2006), 6–7.

10 Maude Southwell Wahlman, *Signs & Symbols: African Images in African American Quilts* (Atlanta: Tinwood Books, 2001).

11 John Michael Vlach, *The Afro-American Tradition in Decorative Arts* (Cleveland: Cleveland Museum of Art, 1978), 74.

12 Shelly Zegart, "Myth and Methodology," *Selvedge* 21 (2008): 43-49.

13 Cuesta Benberry, *Always There: The African-American Presence in American Quilts* (Philadelphia: University of Pennsylvania Press, 1992).

14 Ron Eglash, personal communication, June 29, 2009.

15 "Ron Eglash on African Fractals," TED, posted November 2007, http://www.ted.com/talks/ron_eglash_on_african_fractals.html.

16 Robert Farris Thompson, introduction to Leon, *Who'd a Thought It*, 13–14.

17 Henry Louis Gates Jr., *The Signifying Monkey: A Theory of African-American Literary Criticism* (New York: Oxford University Press, 1988), 52.

18 Mandelbrot, *Fractals and Chaos*, 193–204.

19 Michael Schwarz and Bill Jersey, "Fractals: Hunting the Hidden Dimension," (PBS Home Video, 2008), DVD.

20 Michael Barnsley, *Fractals Everywhere* (San Diego: Academic Press, 1988), 2.

21 Eglash, *African Fractals*, 109-146.

22 *Ibid.*, 71-85.

23 Mandelbrot, *Fractals and Chaos*, 193.

24 Eglash, *African Fractals*, 17–19.

25 Mandelbrot, *Fractals and Chaos*, 198.

26 Nigel Lesmoir-Gordon, Will Rood and Ralph Edney, *Introducing Fractals: A Graphic Guide* (London: Totem Books, 2009), 18.

27 Eglash, *African Fractals*, 147-150

28 Eglash, *African Fractals*, 18-19.

29 Mandelbrot in Briggs, *Fractals*, 71.

30 William Arnett, "Gee's Bend: The Architecture of the Quilt," in *Gee's Bend: The Architecture of the Quilt*, eds Paul Arnett, Joanne Cubbs and Eugene W. Metcalf Jr. (Atlanta: Tinwood Books, 2006), 27.

31 *Ibid.*, 31.

32 Lawrence Rinder, "Greatness Near at Hand," in Rosie Lee Tompkins (Berkeley: Berkeley Art Museum, 1997), 4–5.

33 The studio-art quilt is not relevant to this discussion, because it is akin to painting, as much as to quilting, encompassing as wide a range of styles and techniques, as one might see in the entire field of painting.

34 Schwarz and Jersey, "Fractals".

35 *Ibid.*

36 Leon, *Who'd a Thought It*, 22.

37 Jane Livingston, "Reflections on the Art of Gee's Bend," in Arnett, Cubbs and Metcalf Jr., *Gee's Bend*, 50–52.

38 Leon, *Who'd a Thought It*, 22.

39 Leon, *Accidentally on Purpose*, 46.

40 Leon, *Who'd a Thought It*, 28.

41 Lesmoir-Gordon, Rood and Edney, *Introducing Fractals*, 18.

42 Marcia Birken and Anne C. Coon, *Discovering Patterns in Mathematics and Poetry* (New York: Rodolphi, 2008), 155.

43 Eglash, *African Fractals*, 168.

44 Briggs, *Fractals*, 19.

45 *Ibid.*, 13–21.

46 Arnett, "Gee's Bend," 194.

47 Leon, Accidentally on Purpose, 108.

48 Arnett, "Gee's Bend," 9.