An exploration of Fractal Mathematics as a route to developing a more robust theology for Fresh Expressions of Church.

Pete Brazier
Wesley Study Centre, St John's College

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This dissertation is the product of my own work,
and the work of others has been properly acknowledged throughout.

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Introduction

Some recent statistics might suggest that Fresh Expressions[1] of Church are the definitive answer to the problems of decline faced by the Church in the ever changing cultures of the western world.[2] Many people now recognise that Fresh Expressions are a vital part of the future of the Church, but there are those who believe serious theological questions still need to be asked.[3] There are also some who see the movement as nothing more than an ill conceived attempt to revitalise the Church by bowing down to the fleeting trends of consumerism.[4] So does the concept of Fresh Expressions lack a proper theological grounding?

This dissertation seeks to reframe this conversation by viewing it through a lens of fractal mathematics. Fractals reflect something deep within the created world and hopefully the created world reflects something of God. Therefore it follows that fractals ought to reflect something of God. In particular, fractals are useful for

[1] Throughout this essay the phrase 'Fresh Expressions' will refer to all fresh expressions of Church.
[2] Carey Lodge, *Fresh expressions bucking church decline* http://www.christiantoday.com/article/fresh.expressions.bucking.church.decline/35398.htm (17 May 2014)
[3] Steven Croft, *Mission-shaped Questions: Defining Issues for Today's Church* (London, Church House Publishing, 2008) ix
[4] Andrew Davidson and Alison Milbank, *For the Parish: A critique of Fresh Expressions* (London, SCM Press, 2010) 132

modelling growth patterns and so when investigating the health of new expressions of Church it may well be that the most productive methodology will be an essentially fractal one.

Chapter 1: What is wrong with Fresh Expressions of Church?

Critiques of Fresh Expressions seem to fall into two main categories. The first consists of those written by people who are essentially for the concept and are usually involved with Fresh Expressions in some form, but wish to clarify and correct a particular issue. The others are those who are against the whole endeavour. However, it seems that little of quality has been written from that second category. This may be because most opponents of Fresh Expressions, have little cause to commit themselves to the writing of entire books on the subject. It may also be because there is no coherent, wholesale argument for dismissing the issues raised by Fresh Expressions.

External Critiques

John M. Hull's critique of Fresh Expressions[5] is aimed primarily at the report, Mission Shaped Church.[6] This report has been largely superseded by a number of subsequent books and essays on the subject, such as 'Fresh', 'Evaluating Fresh Expressions' and 'Mission Shaped Questions'. However, Hull's response is illustrative of an important issue that continues to be significant in the way that Fresh Expressions have been misunderstood by some. Hull uses a number of inconsistencies in the language used in Mission Shaped Church to suggest that the theological basis of the report is weak. Yet he never really engages with the fundamental questions about what constitutes Church and how Fresh Expressions may succeed or fail in meeting

[5] John M. Hull, *Mission Shaped Church: A Theological Response* (London, SCM Press, 2006)
[6] Rowan Williams et al, *Mission Shaped Church*, (Wiltshire, Church House Publishing, 2004)

those criteria. He seems unable to grasp the importance of provisionality, which is problematic for a number of his assertions.

Hull's key argument is that the report fails to adequately clarify the difference between Church, Kingdom and Mission.[7] He indicates, based partly on the reports own words, that the essence of the Church cannot be mission, because the Church is a subset of God's mission. He also suggests that it is the Kingdom and not the Church that is the flowering of that mission.[8] This way of thinking fails to acknowledge the provisional nature of Church, whether fresh or inherited. The Church may have God's mission as its driving force and still be a subset of that larger mission. The Church may not be the Kingdom but may still contribute to the work of God by provisionally reflecting and leading towards the Kingdom. Harper and Metzger describe the church as 'a community both of fulfilment and of hope, realizing the blessings of the future while yet awaiting the fullness of these blessings to be revealed at Christ's second coming.'[9] In 'Fresh Expressions and the Kingdom of God'[10] Graham Cray utilizes this to speak of the Church as 'a foretaste of the Kingdom.'[11] These are surely not radically unorthodox concepts, and yet Hull seems to be suggesting that this concept is inherent to the Fresh Expression movement and absent from traditional Church.

[7] Hull, *Response,* 1
[8] Hull, *Response,* 2
[9] Brad Harper and Paul Louis Metzger, 2009 , *Exploring Ecclesiology* (Grand Rapids: Brazos Press, 2009) 48
[10] Graham Cray et al, Fresh Expressions and the Kingdom of God: Ancient Faith, Future Mission (London: Canterbury Press, 2012, Norwich) Kindle Edition
[11] Graham Cray, *Kingdom*, loc 436

The Church will never be the final fruit of the Mission of God, but to suggest that the Church should never bear fruit on the basis of holding God's mission at its heart, would be to render the Church entirely superfluous to the mission. Martyn Atkins states that Churchless mission and missionless Church are equally unsatisfactory.[12] Hull wants clear categories, hierarchies and divisions between Church, Mission and Kingdom, but neither the language nor the world works with that kind of simplicity. If simplicity is required then it needs to be sought in a different way.

In 'For the Parish,' Davidson and Milbank describe Fresh Expressions as having been 'done on a defective methodology, an inadequate theology, and by accepting the very choice-led individualism from which Christianity should seek to liberate us'[13] The charge of choice led individualism is not entirely without merit; after all Fresh Expressions are in part about new options of how to be Church. One of the continuing challenges of Fresh Expressions, is how to remain rooted in the wider Church and challenge people to encounter those who are culturally different from themselves. This critique however ignores three significant points.

Firstly, it fails to deal with the notion that inherited church already involves a great deal of choice; for example, whether or not to engage with Church in the first place and choices between denominations and worship styles of inherited Church. If a traditional congregation is primarily made up of middle class, white elderly women, it

[12] Martyn Atkins "What is the Essence of the Church?" in, Steven Croft et al, *Mission Shaped Questions: Defining issues for today's Church* (London: Church House Publishing, 2008) 20
[13] Davidson and Milbank, *Parish*, vii

is unlikely that this demographic has a greater inherent capacity for faith. It is more likely that this congregation has already tailored its activities to the needs and preferences of those people.

Secondly, it underestimates the importance of culture as more than just a set of consumer choices. Church has never existed separate from culture and language, so it would be wrong to pretend that the church can ever avoid the questions of how to engage with the current culture into which it is being expressed.

Thirdly, it ignores the possibility that a choice might be made on the basis of significant theological or ecclesiological differences and the availability of appropriate alternatives. Davidson and Milbank speak primarily from an Anglican viewpoint and, without even considering the theological diversity of the wider denominational landscape, there is already a significant theological diversity within the Anglican Communion. Choice is an unavoidable part of how the theology of the Church is worked out in practice. In a consumer led society there may be a greater need to engage with and challenge the issues connected with choice and commitment, but there has never been a time when Christians did not need to make decisions about how to worship.

'For the Parish' is a flawed critique of Fresh Expressions, but its inclusion here is not intended to set up a straw man argument against Davidson and Milbank; rather it is to use 'For the Parish' as being representative of views held by people who have

misunderstood some vital aspects of Fresh Expressions and have not grasped its deeper theological grounding.

One of the key errors in 'For the Parish' is that of misunderstanding the relationship between essence and the incarnational reality of the Church. Davidson and Milbank say that 'the movement seeks to separate form and content, with the assumption that the essence of the Church exists separately from its living forms, [...] adherents of Fresh Expressions believe that the Church can be divested of her inherited practices, structures and disciplines and go on to be re-expressed in new ways, with little or no sense of loss.'[14] This statement and its subsequent exploration through the book, makes a number of fundamental mistakes. Firstly, it assumes that the current forms of Church are without error. Secondly, it presumes that their activities comprehensively represent what Church ought to be. Thirdly, it assumes that these forms represent all that church can be. Fourthly it assumes that traditional church has historically existed without significant change. If any of these things are not true then the statement falls apart.

If something is lost in Fresh Expressions then it follows that similar things were lost in the forming of the Church of England and every other denomination. In all denominational divides, practice changed to some extent on the basis of reinterpreting the essence or principles of what it meant to be Church. If the Church should not be reinterpreted for a new context then it follows that its current practices

[14] Davidson and Milbank, *Parish*, viii

are both universally sufficient and the limit of what we will seek to be, in spite of the fact that across the traditions of the World Church there were many differences in practice long before the concept of Fresh Expressions was ever voiced.

I suspect however, that this error has been made primarily on their suggestion that, in Fresh Expressions, the essence of church is ever thought to exist separate from its incarnation and that the incarnation of church is synonymous with its practices. The Church once existed without organs and pews but was still the Church.[15] It existed before the practice of All Saints Day, Ash Wednesday and Christmas, but was still the Church. It existed before every member who is alive today was born. However, the Church has never existed as essence alone, it has always had people and practices, and the people and practices have always been in a state of change. This is no more or less true of Fresh Expressions. The difference with Fresh Expressions is that there is a conscious effort to better comprehend that essence in response to the increasing rate of change in culture.[16]

The poorly argued nature of Davidson and Milbank's critique of Fresh Expressions might normally be grounds to dismiss the validity of their contribution to the argument. However, a significant part of the problem is that Fresh Expressions are not for the most part being implemented by theologians from academic circles. There are a limited number of people who are sufficiently trained in thinking on a deep

[15] David Goodhew et al., *Fresh: An Introduction to Fresh Expresssions of Church and Pioneer Ministry* (London, SCM Press, 2012) 38
[16] Anglican-Methodist Working Party, *Fresh Expressions in the Mission of the Church* (London: Church House Publishing, 2012) 2.2.2 & 2.3.2

philosophical level about the implications and possibilities of culturally contextualized ecclesiologies, to fully understand what Fresh Expressions are and how they relate to the inherited forms of Church. Even if those who lead Fresh Expressions are well trained in the necessary theological concepts, those who are called to follow may not be. In addition, many people from traditional or inherited church, when asked to allow resources to be freed up in order to support Fresh Expressions have struggled to comprehend the true merits of this endeavour.

Internal Critiques

Critics have often asked whether or not a Fresh Expression is fully Church or at what point it achieves maturity as a church.[17] Whilst this is a useful and important set of questions, it is equally important to ask the same questions of inherited church.[18] As a result the Fresh Expressions movement has had a significant role in deepening engagement with the question, 'what is Church?'

I have personally observed a conceptual firewall between what might be described as genuine Fresh Expressions and the understanding held by many Christians. There are a large number of people whose understanding of Fresh Expressions has been on the basis of experiencing an 'off the shelf' version of an activity done elsewhere. Most commonly this has been Messy Church. The first Messy Church set up by Lucy Moore should certainly be defined as a Fresh Expression, but

[17] John Drane "What does maturity in the emerging Church look like" in Croft, *Questions*, 90-101
[18] Louise Nelstrop and Martin Percy (Eds), *Evaluating Fresh Expressions: Explorations in emerging Church* (London: Canterbury Press Norwich, 2008) xi

most of the subsequent Messy Churches are essentially an inherited form of Church. People may have looked deeply into the needs of their community and found that what is needed coincided with Moore's pattern, but more often than not congregations set up a Messy Church primarily on the basis that they have seen it work elsewhere. This is not in itself a bad thing to do, but it misses a fundamental element of Fresh Expressions.

In the reworking of the definition of Fresh Expressions from May 2006, it states that they will 'come into being through principles of listening, service, incarnational mission and making disciples.'[19] The emphasis on listening is one that is often missed by those who have not understood the concept of Fresh Expressions; many people prefer to think in terms of the activities they can see, rather than the principles and the processes driving that situation. Mission Shaped Church puts forward the concept of double listening, which is explored more deeply by Hollinghurst in Mission Shaped Evangelism.[20] This is the concept of listening first to what God is already doing in the Cultural context[21] and then listening to God through the traditions and writings of the Christian Church.[22] This is a fundamental part of how a good Fresh Expression of Church is developed in practice. It is important not to make the mistake of thinking that it is about first listening to the world and then listening to God[23], a mistake

[19] Steven Croft "What counts as a Fresh Expression of Church and who decides?" in Nelstrop and Percy, *Evaluating*, 10
[20] Steve Hollinghurst, *Mission Shaped Evangelism* (London: Canterbury Press Norwich, 2010) 1
[21] Hollinghurst, *Evangelism, 7-97*
[22] Hollinghurst, *Evangelism, 99-164*
[23] Hollinghurst, *Evangelism, 5*

frequently made by those who see Fresh Expressions as a desire to follow consumer choice.

One further critique from within the world of Fresh Expressions comes from Robin Gamble, who characterises the relationship between the mixed economies of inherited and Fresh Expression in terms of a mother child relationship.[24] He notes an unproductive tendency from the child to be unnecessarily critical of the parent, even though they are made of the same substance. Perhaps a theological discussion could develop in terms of comparing God the father as homoousias with the son and 'Mother Church' being homoousias with the 'Fresh Expression Child'.

Reframing the conversation

In Mission Shaped Questions, Dunn makes a strong case for the idea that Fresh Expressions, far from being a passing fad, are intrinsically part of how church was intended to function from the beginning. Dunn suggests that the early church can be seen as a fresh expression of Judaism;[25] that reinterpreting scripture and tradition in the light of cultural change was fundamentally part of the methodology of Christ. Dunn states this in a way that is hard to dismiss when he says, 'The character of Christianity as a fresh expression is enshrined in our sacred texts' and concludes that

[24] Robin Gamble, "Mixed economy, nice slogan or working reality?" in Nelstrop and Percy, *Evaluating, 15-17*

[25] James Dunn, "Is there evidence for Fresh Expressions of Church in the New Testament?" in Croft, *Questions,* 58

'Christianity that has lost all sense of newness [...] is no longer Christianity as defined by the New Testament'[26]

This suggestion reframes the conversation about Fresh Expressions. Rather than asking in what ways Fresh Expressions fail or succeed in living up to the standards of inherited church, we might find ourselves asking, what is the difference, if any between fresh and inherited forms of Church? Perhaps in their underlying nature there ought to be no difference; the Church should be the Church; the same theology should shape the whole mission. However, what we see in Fresh Expressions is an acknowledgement of the increased rate of cultural change, and a lack of capacity in the inherited church to respond effectively to that rate of change.

Gamble suggests that the much spoken of 'mission shape' ought to be preceded by a 'missionary spirit.'[27] If we think of the missional spirit as the essence of the shape, then the missional shaping of Church is a matter of external geometry; the outline of the ecclesiology. Therefore what is required is a method of describing and potentially transforming these missional shapes in terms of their internal essence, but not without reference to the existing external or incarnational existence.

Essentially, it seems there is very little wrong with the concept of Fresh Expressions, the problem lies in the Church's ability to understand how to apply or iterate the concepts of Fresh Expressions faithfully. It is my suggestion that much of the difficulty in faithfully iterating Fresh Expressions is rooted in the tendency to copy

[26] Dunn "New Testament" in Croft, *Questions,* 64
[27] Gamble "Mixed" in Nelstrop and Percy, *Evaluating,* 18

and paste from the outward geometry, rather than from the essence or principles that define Church. Each time the Church is copied and pasted it is likely that corruption and contamination of the principles may occur over time. However it is also true that if Church is iterated entirely from a set of principles without regard to or connection with the Church as it already is, then the principles fail to be informed by traditions through which people have encountered God and the details of Christian experience may be lost. Fractal geometry offers a new way of looking at these issues, by allowing us to rethink the relationship between inner principles and the outward missional shape.

Chapter 2: What are Fractals and how do they reflect Creation?

There are two main ways in which fractal mathematics reflect creation. These follow two separate definitions of fractals; one definition concentrates on the mathematical concepts that underpin the subject and the other concentrates on the geometry created or observed by this field of mathematics. The latter is far more recognisable and comprehensible to the general public. The former is incomprehensible without some understanding of higher level mathematics; it is however no less part of the story of fractals and their relationship to creation. It is therefore worthwhile taking a little time to understand its meaning.

Definition 1:

> "A fractal is by definition a set for which the Hausdorff Besicovitch dimension strictly exceeds the topological dimension."[28]

The first way in which fractals reflect nature is best understood by establishing a sense of where fractal geometry comes from. Geometry, from the Greek *γῆ* (gē) meaning earth or soil,[29] always aspired to describe the world mathematically. However, historically most mathematicians believed that geometry based on squares, triangles and circles was normal, whereas irregular, complex shapes, sometimes labelled as monsters were anomalies that should be avoided.[30]

[28] Benoit B. Mandelbrot, *The Fractal Geometry of Nature* (New York: Freeman, Kindle Edition, 2010) 15
[29] William D. Mounce, Mounce Concise Greek-English Dictionary of the New Testament (Accordance Edition, 2011) GK1178
[30] Mandelbrot, *Nature,* 3

That simplistic geometry, which is often called Euclidian Geometry after Greek mathematician Euclid, does not reflect creation, which is primarily populated by such monsters. Benoit B. Mandelbrot acknowledged a reluctance for mathematicians to describe the complexity of the real world and notes how there was a celebration of the uselessness of pure mathematics amongst many of its proponents.[31] Mandelbrot's new geometry seeks to describe that which Euclidian geometry failed to describe. In 1975 Mandelbrot coined the word Fractal to describe this geometry based upon the Latin word *fractus* which means broken or fractured.[32]

Understanding how this geometry works and how it describes natural forms will involve rethinking the concept of dimensions. Most people would probably think of dimensions in terms of the length, breadth and depth, perhaps with an additional fourth dimension of time. But in mathematics, dimensions can be thought of in terms of the necessary instructions required for describing a particular shape. Both a rectangle and a circle are normally thought of as two dimensional objects, but in terms of necessary descriptors the rectangle needs two measurements but the circle, as long as we are not describing its position or the area inside the circle, only needs a radius length, making it one dimensional. Also a circle, as opposed to a disc, is just a single line. With that in mind, if a tree is described by its length, breadth and depth, this does not even begin to describe its true shape.

[31] Mandelbrot, *Nature*, 3-4
[32] Mandelbrot, *Nature*, 4

In non mathematical terms, a curve might be thought of as a line that is not straight and has no sharp edges. However in the world of geometry, such a curve is one that has a tangent; that is to say, at any point along the line, you can measure its angle. In fractal mathematics many curves exist where the tangent cannot be found because there may be straight sections and sharp corners. In 1906, Jean Perrin suggested that curves without a tangent were the norm and shapes like circles were 'interesting but quite special'.[33] In 1890 Giuseppe Peano described such a line, known as the Peano Curve, that could be reduced in scale and copied infinitely until, at least in theory, it would fill the entire plane.[34] In a similar way a child might scribble with the intent of filling an entire space but still only use one line. In this sense, the line stands somewhere between a one dimensional and a two dimensional shape. This is known as the Hausdorff Dimension and was devised by Felix Hausdorff in 1919.[35] When measuring the limits of an irregular area like a coastline the Hausdorff or Hausdorff Besicovitch dimension becomes a significant issue.

If a coastline is measured in one mile sections it will return a particular length, but if the measurement is done in metres, the total length will be significantly larger because of the greater number of details that can be included in the measurement. There is no limit or average to this; the measurement of the coastline continues to increase as the scale of measurement decreases, right down a molecular level. So the

[33] Manfred Schroeder, *Fractals, Chaos, Power Laws: Minutes from an Infinite Paradise* (New York: Dover, 2009) 8
[34] Mandelbrot, *Nature,* 14
[35] Mark Pollicott, *Introduction*, in "Lectures on Fractals and Dimension theory" (2005) 3 http://homepages.warwick.ac.uk/~masdbl/dimension-total.pdf (13 Jan 2014)

topological dimension of the coastline is 1. It is a single line and not the area of the island that is being considered. But the Hausdorff dimension stands between 1 and 2 as the line has a certain level of bumpiness as Mandelbrot describes it.

There are many ways to look at an object and an infinite number of scales at which an object can be measured. So it is useful to speak in terms of limits and effective dimensions.[36] Mandelbrot explains this in terms of a ball of thread that from a distance may appear as a point and therefore be zero dimensional, as it becomes closer it may appear as a three dimensional object. At a very close range it may appear as a mass of one dimensional threads. Then closer still the threads become three dimensional and so on down to an atomic or sub atomic level.[37] Hence, the dimensions of a line, surface or object are dictated in part by the scale of measurement and the scale of measurement is dictated by the reason why the object is being described.

Definition 2:

> "A curve or geometrical figure, each part of which has the same statistical character as the whole. They are useful in modelling structures (such as snowflakes) in which similar patterns recur at progressively smaller scales, and in describing partly random or chaotic phenomena such as crystal growth and galaxy formation."[38]

This self similar aspect of fractal geometry is interested in the way that patterns are repeated at different scales and is an aspect that has drawn a great deal

[36] Mandelbrot, *Nature*, 17
[37] Mandelbrot, *Nature,* 17-18
[38] Oxford Dictionary, http://www.oxforddictionaries.com/definition/english/fractal (13 Jan 2014)

of interest in the subject from far beyond the world of mathematics. In its purest form, this self similarity can be seen in shapes which can be copied, reduced in scale and infinitely mapped onto themselves.

Prior to Mandelbrot coining the term fractal, a number of these self similar shapes such as the Koch Snowflake (1904), the Sierpinski Triangle (1915) and the Fibonacci sequence which dates back to at least the 13th century, had already come to the attention of mathematicians.

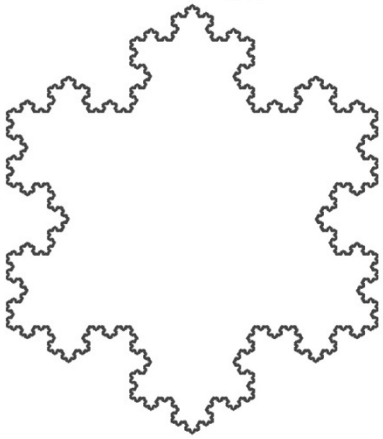

Figure 1: Koch Snowflake

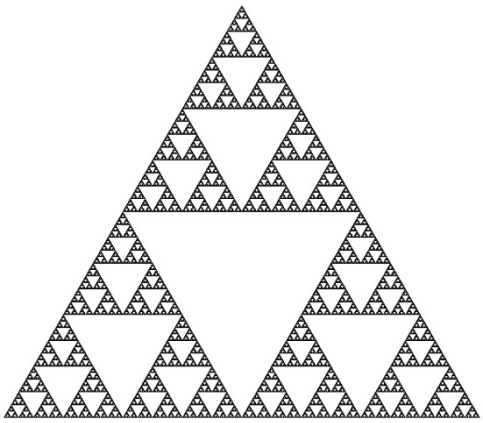

Figure 2: Sierpinski Triangle

The Fibonacci sequence is based on the reproductive rate of rabbits. Assuming that rabbits mature in one season, pairs give birth to one new pair each season and the rabbits never die, Fibonacci showed that population of rabbits in the next season could be calculated by adding the number of the previous season to the current season.[39] What is fascinating for fractal mathematicians and theologians alike is the number of places that this sequence can be found in nature. It is an integer version of the Golden ratio of 1:1.618 which has its roots in ancient Greece. The Golden ratio and

[39] Schroeder, *Chaos,* 54-55

the Fibonacci Sequence can be seen occurring in a vast number of natural situations. This expanding ratio can be seen in the shape of eggs, spiral galaxies, large storms, snail shells, flower heads and the arrangement of leaves on an aloe plant.[40] Perhaps one of the most striking examples is in romanesco broccoli which displays the Fibonacci sequence at several self similar scales.[41]

Mandelbrot sees self similarity or invariance as an essential aspect of studying fractals but notes that 'invariance must be modified and/or restricted in its scope.'[42] He also notes that not all fractals have this aspect of self similarity, stating that 'While the primary term fractal points to disorder and covers cases of intractable irregularity, the modifier scaling points to a kind of order.'[43] This distinction between scaling and non scaling fractals is rarely picked up by others, but the enthusiasm that many have for fractals should be tempered with the understanding that as of yet there is no equation, simple or complex that describes, without modification, the entire geometry of our universe.

Manfred Schroeder states that 'The unifying concept underlying fractals, chaos, and power laws is self-similarity,' and goes on to say 'Self-similarity is, in fact, one of the decisive symmetries that shape our universe and our efforts to comprehend it.'[44] Schroeder takes the concept of invariance and expands it to a cosmic scale which

[40] *The Fibonacci Sequence in Nature,* http://www.inspirationgreen.com/fibonacci-sequence-in-nature.html (14 Jan 2014)
[41] John Walker, *Fractal Food: Self-Similarity on the Supermarket Shelf*, 2005 http://www.fourmilab.ch/images/Romanesco/ (14 Jan 2014)
[42] Mandelbrot, *Nature*, 18
[43] Mandelbrot, *Nature*, 18
[44] Schroeder, *Chaos*, xiii

includes all of time and space. He points out our intrinsic belief is that 'the laws of nature are the same all over the cosmos—and that they have been, and will remain so, for all time.'[45] It seems a curious thing for a scientist to make a statement of belief about scientific things, yet this is very much what it is. No one has ever proved that the laws of physics are universal, and yet it would seem to be a belief that most human beings share in one form or another.

Schroeder also notes the identical nature of all sub atomic particles wherever they are found. He says 'There simply is no difference between an electron here and an electron there—on a distant star.'[46] A belief that is curiously congruent with a Christian sense of created order. Self similarity seems to tap into something intuitive within human understanding of the universe. Long before a person can feed real and imaginary numbers into a fractal equation and iterate some complex piece of geometry, they can look at the similarity between a leafless tree and a lightning bolt and say, 'I get it.'

Limits

The fundamental task of geometry is defining the limits of a space, but the repetitions of patterns in the world around us also have limits of scale,[47] for example the branching and scaling of tubes in human lungs display a significant amount of fractal self similarity; mathematically, they could keep subdividing ad infinitum.

[45] Schroeder, *Chaos*, xiii
[46] Schroeder, *Chaos*, xiv
[47] Mandelbrot, *Nature*, 38

However, that would be neither physically possible nor useful. Lungs are formed in such a way as to create the maximum surface area in the minimum space, but the size of the smallest tubes is dictated by what needs to pass through them.[48] With the coast line there is a point at which the movement of the water negates the accuracy of the measurement and below that, at a sub atomic level there is no difference between sea and shore.

In fractal geometry a simple equation like the Mandelbrot Set ($z=z^2+c$) can, in theory, be iterated to infinity creating immensely beautiful images. But there is a need to set a limit for the iterations so that it doesn't take an infinite amount of time for your computer to calculate the image. Fractals are immensely useful in generating astoundingly realistic landscapes for films and computer games, but if there is no expert there to set the limits and parameters or choose the right fractal equations then these landscapes will not work. So this begs the question in the physical world of how the equations and the limits interact without our intervention.

Effects on our perception of creation

Psalm 139:7 says 'Where can I escape from your Spirit? Where can I flee from your presence?' The words of this psalm suggest that God is present in all places, at all times and is aware of all things, not just the external, visible things but the internal and intrinsic nature of individual human beings and the whole universe. It is intriguing that mathematicians at the beginning of the last century were so pleased at having

[48] Michael Frame, *"Stories About Nature: Michael Frame at TEDxYale"*, Ted Talk Video, 2013, 2:05-3:00 http://tedxtalks.ted.com/video/Stories-About-Nature-Michael-Fr (13 Jan 2014)

found areas of mathematics that they thought to be totally detached from the real world. Yet it was these very areas of mathematics that gave Mandelbrot the building blocks to work on fractals that were so intrinsically linked with the real world. It does perhaps suggest that, just as the Psalm implies, it is impossible to run away from God or the nature of the created universe. Even within abstract concepts these mathematicians were drawn back to the tangible reality of the world.

Fractals do more than reflect nature; they also tell us something about the underlying mathematics of nature. Fractals suggest that what may at first appear disorganised or random may actually be highly organised. Michael Frame speaks about fractals in terms of patterns of growth. He shows how a tree, cauliflower or a lung has a fractal pattern that is repeated and scaled down as far as is physically useful.[49] If fractals are thought of as growth patterns then it both informs us about the nature of how DNA functions and throws up many questions about how fractal equations might be, as it were, programmed into DNA sequences.

Seemingly chaotic systems like storms, the formations of mountains and the flow of a river can be modelled using fractal geometry and so previously unseen patterns can be found. Just as Fibonacci could begin to predict the growth of rabbit populations centuries ago, now we are beginning to be able to model things we could only guess at before, like weather, volcanoes, earthquakes, markets, the spread of

[49] Frame, *Stories,* 7:34

epidemics and so on.[50] Though clearly we have not mastered modelling any of these dynamics as of yet.

The most widely enjoyed application of fractals is in the world of film and computer gaming, where fractals have allowed the creation of believable landscapes that only exist within a computer. Reproducing the seemingly random complexity of mountains, clouds and forests used to take artists many hours to paint as two dimensional backdrops, but they can now be rendered on a computer in a matter of seconds and can be shown from any angle.

Fractals have allowed us to virtually recreate our own world and imagine new worlds within a computer, but fractals are also informing our sense of how the real world was created. One of the great struggles in the dialogue between science and theology on the subject of creation, is that some Christians believe in a static creation where everything is put in place, God presses the start button and then stands back to watch. In fractal geometry there are patterns of growth which appear to be intrinsically part of the way the universe functions; from the big bang, through the formation of galaxies and stars, to the growth of trees, lungs and mould. Some would argue that this is evidence that there is no need for a God; others might suggest that the presence of inherent growth patterns means that all the information was there at creation and no further input was needed from God. I rather prefer the interpretation that this is a glimpse of God's constant fingerprint upon the universe.

[50] Schroeder*, Chaos,* 28, 126 & 345

One important theological conversation about creation is the question of creation *ex-nihilo* (out of nothing) versus order out of chaos.[51] An interesting tilt that fractals put upon this conversation, is the idea that seemingly vast and chaotic systems can be created out of incredibly simple equations. Fractals do not create order out of chaos nor do they create universes out of nothing. However they do help us to recognise the unseen order within that which was once perceived as chaotic.

Fractals have not brought us any closer to being able to create stars or galaxies on the basis of a simple equation, but they have perhaps given us a view of the cascading mathematical systems that are involved in such processes. Fractals are not the answer to every mathematical question, they cannot describe every aspect of our universe and they should not be mistaken for God. However, they have exponentially advanced our ability to describe the world we live in. Through fractals we are learning that creation is complex, but more deeply comprehensible than we previously thought. Fathoming the unfathomable has significant implications for how God is viewed in creation, as a God of the gaps, who only does the things we do not understand, becomes more of an illogical concept. Conversely a God who is recognisable and visible through patterns that reflect God's nature is perhaps becoming more feasible than before. Fractals show that despite the infinite complexity we see around us in the universe, creation appears to have an underlying simplicity that is waiting to be discovered.

[51] John D. Levenson 'Genesis' in Adele Berlin & Mark Zvi Brettler, *The Jewish Study Bible* (New York: Oxford University Press, 2004) 13

Chapter 3: The Journey from Economics

Before applying fractals to theology it might be wise to see what may be learned from their initial application to the field of economics. Fractal geometry was from the beginning, an applied form of mathematics with a strong element of intuitive interpretation. It made good use of some highly abstract and pure or theoretical mathematical concepts,[52] but it originated from observations of real world data.[53] It has subsequently been reapplied to numerous fields of study. Mandelbrot coined the word 'fractal' in 1975 but back in the 1950's and 1960's[54] he had already been working on concepts like Fractional Brownian Motion[55] in the world of economics.

Initially Mandelbrot's findings were not well received by the financial community and even today there are many who have not fully taken on the significance of his work. Mandelbrot puts it in a way that is surprisingly appropriate for the context of a theological essay when he says, '"Modern finance" was the official religion. My hypothesis contradicted it; and I was about as welcome in the established church of economics as a heretical Arian at the Council of Nicene.'[56] Like the Church, the world of business can sometimes suffer under, rather than benefit from its traditions, and the acceptance of fractals as an essential part of the financial tool box has been no exception.

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[52] Mandelbrot, *Nature*, 16
[53] Benoit B. Mandelbrot & Richard L. Hudson, *The (Mis)behaviour of Markets: A fractal view of risk ruin and reward* (London: Profile Books 2008)13
[54] Benoit B. Mandelbrot, *Fractals and Scaling in Finance: Discontinuity, Concentration, Risk* (New York: Springer, 1997) 3
[55] Mandelbrot, *Misbehaviour*, xiv
[56] Mandelbrot, *Misbehaviour*, 167

There are now those who recognise the importance of his work and how he has changed the way we view the world.[57] However there are also those who are attempting to use Mandelbrot's work to create get rich quick plans. In 'the (Mis)behaviour of markets' Mandelbrot hints at a number of ways in which he is unhappy with some of these applications of fractals.[58] In part, his concern appears to be ethical in nature, as his interest in the use of Fractals in finance seems to come from two primary motivations; the furthering of science and the wellbeing of human life. Mandelbrot states that;

> "It is beyond belief that we know so little about how people get rich or poor, about how it is they come to dwell in comfort and health or die in penury and disease. Financial markets are the machines in which much of human welfare is decided; yet we know more about how our car engines work than about how our global financial system functions."[59]

His other reservation about this usage of his work seems to be rooted in the fact that this is not how fractals work; they are not, at least at this stage, able to tell the future.[60] It is one thing to analyse the past, to make accounts add up and to be able to point to trends and the factors that affected the market at any one point. However, the prediction of future trends in any market is notoriously difficult. And there are two main reasons for this;

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[57] Yasmine Hayek Kobeissi, *Multifractal Financial Markets: An alternative approach to Asset and Risk management* (London: Springer, 2013) vii, xiii
[58] Mandelbrot, *Misbehaviour,* 255
[59] Mandelbrot, *Misbehaviour,* 254
[60] Mandelbrot, *Misbehaviour,* 19

1. Markets are not sealed systems, but systems that are affected both by the external environment and by the decisions of real unique human beings. In fact the market that is being predicted is affected by those who make predictions about it, hence creating infinite data loops within already impossible calculations.

2. Any predictions using traditional probability theories have no way of using the past to guide the future. If you roll a dice there is a six to one chance of rolling a six. The chances of getting four fives in a row are 1 in 1,296. However if you throw a six on your first roll, the probability is still 1 in 6 of rolling a subsequent six, and so on. Whatever you throw in with the first three dice, the probability remains unchanged for the future. You can't use past results to narrow future probabilities in this way.

Economists have always been in the business of trying to predict markets and Mandelbrot makes a significant contribution to that field. However he suggests that markets are not simple enough to predict yet in the way that could guarantee profit for the individual. Some of the knowledge needed to make such assessments is 'unknown or unknowable,' and markets can often respond inconsistently to similar causes.

Modern Finance[61] was born out of the work of Louis Bachelier at the beginning of the 20th century [62] and is a theory based on the idea of a random walk, where the market rises or falls each day within a certain limit. Like the dice, it is not dependant on historical prices. The range of possible rise or fall is calculated using a distribution

[61] Mandelbrot *Misbehaviour, 9*
[62] Mandelbrot *Finance,* 5

curve variously called the 'bell curve', 'Gaussian distribution' or 'normal distribution' and is recognisable in a large number of real world situations. The Gaussian curve suggests that 68% of the shifts up or down will be within one standard deviation[63] of the previous state and 95% will be within two standard deviations.[64] This system presumes that any wide price changes are statistically negligible.

There are a number of subsequent variations on this theme such as Black Sholes, CAPM and the Efficient Market's Hypothesis, but all of these rely on Gaussian distributions.[65] Through fractal analysis of various markets, beginning with cotton prices around the Nile, Mandelbrot was able to make five important observations. Firstly, many markets did not fit with this standard deviation. They required curves with a high concentration around the centre but with 'fat tails'[66] that produce those wildly erratic events of boom and bust, which traditional economic models have been so poor at predicting. In short, markets are riskier than most economists would like to think and the various market crashes that have happened over the last hundred years, right up to the global recession of 2008, are testament to that fact.[67]

Secondly, contrary to the dice, markets have a memory; significant jumps in the market can be recurring and 'turbulence tends to cluster'.[68] Thirdly, markets have a personality or a set of characteristics. Fractals offer ways of observing that behaviour

[63] One standard deviation is the square root of the variance. Variance is the sum of the square of the differences between each number in the set and the mean, divided by the number of values in the set.
[64] Mandelbrot *Misbehaviour, 9*
[65] Mandelbrot *Misbehaviour, 60-1*
[66] Hudson, in Mandelbrot, *Misbehaviour*, xxiv
[67] Mandelbrot, *Misbehaviour,* 20
[68] Mandelbrot, *Misbehaviour,* 19-21

or personality and generating far more convincing models of markets than have been achieved by any other system. And as Mandelbrot states; 'to be able to imitate reality is a form of understanding.'[69] Fourthly, the patterns that markets seem to display are generally misleading. Fifthly, the relative volatility of the market, changes the speed that change happens. So any good analysis of the market needs to take this shifting time frame into account.

Fractals demonstrate that a market is never static and in fact the relative stability that is normally seen in markets is made up of lots of constantly changing influences and factors. There are normally discontinuities at all levels of scale. Diversity tends to hold these discontinuities in balance; it is only when these discontinuities coincide that rapid expansions and crashes occur in the market.[70]

Part of what fractals offer is a way of giving shape to the randomness in graphs. At a basic fractal level it is possible to measure the Hausdorf dimension of a graph, hence demonstrating how much randomness there really is in a market rather than assuming a general randomness.[71] But Mandelbrot also suggests that there are different kinds of randomness and he describes three states of randomness; mild, slow and wild.[72] Mild randomness can be seen in the nature of most solid objects. At the scale of the whole object there is little randomness. A box has clearly definable, straight edges. But look at the same box at a microscopic level and the surface

[69] Mandelbrot, *Misbehaviour,* 19-20
[70] Steve Keen, *Behavioural Finance 2011 Lecture 05 Fractal Finance Markets Part 2*, http://www.youtube.com/watch?v=hXZChyvfMfA (04 June 2014)
[71] Keen, *Behavioural Finance Part 1*
[72] Mandelbrot, *Misbehaviour,* 33

becomes highly random. These random features might be important in some circumstances but when speaking of the box as a box they are of negligible significance. The Wild randomness is seen in gasses which have random elements of movement at all levels of scaling. Slow randomness, like liquids stand between the two.

Mandelbrot points out how traditional economists presume that the randomness of markets is mild when in fact it is clearly wild and often reflects the kind of turbulence seen in the behaviour of gasses. As John 3:8 puts it 'The wind blows where it chooses, and you hear the sound of it, but you do not know where it comes from or where it goes. So it is with everyone who is born of the Spirit."

On the event of Mandelbrot's death in 2010, Jack Challoner wrote an article for the BBC stating that 'The whole universe is fractal, and so there is something joyfully quintessential about Mandelbrot's insights.'[73] He goes on to list some of the applications of fractal mathematics as computer graphics, file compression systems, network architectures of the internet and medical diagnoses. He also mentions how fractals can be used to analyse systems and ' describe the unpredictable.'[74]

The extent to which fractals have been applied to and explored within so many fields of study is not just diverse but staggeringly diverse. It is also notable how many proponents of the use of fractals in each of these fields are happy to apply such

[73] Jack Challoner, *How Mandelbrot's fractals changed the world*, 2010, http://www.bbc.co.uk/news/magazine-11564766 (16 June 2014)
[74] Challoner, *Mandelbrot*

sweeping statements as 'we are fractal,'[75] or 'geology is fractal'[76] and even to use the phrase 'the thumbprint of God'[77] to describe Mandelbrot's most famous fractal, the Mandelbrot set.

Mandelbrot was a Polish Jew who grew up in France during the Second World War,[78] his fractal geometry grew up in the volatile world of global finances. It is hard to imagine a more real world starting point for this new area of applied Mathematics, and yet there remains something abstract and other-worldly about many of the images produced by this form of mathematics, and in the absence of Mandelbrot himself we are left to imagine how these fractals might now be applied to yet another field of study.

[75] Clifford Brown and Larry Liebovitch, *Fractal Analysis* (London: Sage, 2010) 24
[76] Lynn S. Fichter and Steve J. Baedke, *The Fractal Nature of Structural Geology During the Late Paleozoic Alleghanian Orogeny in the Mid-Atlantic Region of the United States*, 2000 http://csmres.jmu.edu/geollab/vageol/vahist/Fracstru.html (17 June 2014)
[77] Mister X *THE MANDELBROT SET "Thumbprint of God"* http://www.misterx.ca/Mandelbrot_Set---Thumb_Print_of_God.html (17 June 2014)
[78] Mandelbrot, *Misbehaviour, xxi*

Chapter 4: Fractal Theology and Fractal Ecclesiology

The story of fractal Theology so far

Fractal theology is very new territory. At this stage, little has been written on the subject and most of what has been written can be found on internet blogs and in self published books rather than on the bookshelves of academia.

Wayne Cordeiro offers a fractal model of church team building[79] that is also picked up by Ralph Moore.[80] This will be discussed in the final chapter. Vox Day's contribution to the fractal theological conversation is in some ways minimal as he is primarily using fractals in connection with the anthropic principle as part of a rebuttal of Richard Dawkins and New Atheism. However, Day highlights the importance of how fractals echo the way the universe shifts from simplicity to complexity.[81] This is a significant part of how fractals reflect the nature of creation and therefore how fractals reflect the nature of God, but it is also a useful reminder to the church that like the universe our practices were not always so complex.

Michael Bull offers an interesting insight into the fractal nature of the Bible as he observes theological themes and literary structures that echo and repeat at different scales, particularly across the Old Testament.[82] His approach is essentially a

[79] Wayne Cordeiro, *Doing Church as a Team: The miracle of teamwork and how it transforms churches* (California: Regal Books, 2004) 172-90
[80] Ralph Moore, *Starting a New Church* (California: Regal Books, 2002) 83
[81] Vox Day, *The Irrational Atheist: Dissecting the Unholy Trinity of Dawkins, Harris and Hitchens* (Dallas: Benbella, Books, 2008) 151-55
[82] Michael Bull, *Bible Matrix: An introduction to the DNA of the Scriptures*(Bloomington: WestBow Press, 2010) 6

narrative, typological hermeneutic that encourages the reader to be imprinted by the patterns of God either consciously or subconsciously by the text. The major flaw in his work is that he places too much stress on the themes of the seven day creation story, and has an unrealistic expectation on separate texts of the Bible to have this seven part thematic structure running all the way through. However he does offer a useful insight as he sees the text as having an 'organic movement from beginnings to ends.'[83]

Fractal Theology has also been briefly addressed in the Jewish Community. Rabi Raachel Jurovics draws on the idea of every part of God representing the whole. She suggests that when we encounter a small part of God, we meet the whole of God even if we comprehend only that small part. Jurovics suggests that 'A fractal may be understood as a mathematically poetic form [...] a rough or fragmented shape that can be split into parts, each of which is recognizable as a reduced-size copy of the whole. As the Hasidim teach, in taking hold of a shred of the unity of God, we take the whole of it in hand.'[84]

She notes that this concept is not entirely new, having been suggested in a way by 13th century teacher Nachmanides who says 'the whole Torah is comprised of Names of the Holy One, blessed be God, and that the letters of the words separate themselves into Divine Names when divided in a different manner.'

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[83] Bull, *Matrix,* 1

[84] Raachel Jurovics*, Sacred Fragments: A Fractal Theology: Yom Kippur Shachrit* Sermon, 2010 http://yavneh-raleigh.org/worship/rabbi-entry/2010-09-18/sacred-fragments-fractal-theology (14 Jul 2014)

Jurovics sees Yom Kippur as being fractal because it is a 'Sabbath of Sabbaths'. She also sees the fractal nature of human beings being made in the image of God as an opportunity for seeking an understanding of God in our own image. She says, 'finding God in our own fractal image is not an egoistic exercise in reverse engineering, so long as we recognize ourselves and all being as the direct manifestation of One.'

Winkie Pratney gets muddled between chaos, fractals and quantum theory and hence is not the best theoretician for this new field, but he is filled with an appropriate and childlike enthusiasm for the mathematical and scientific discoveries that are taking us past a world of Newtonian Physics and Euclidian Mathematics into a world of intrinsic complexity, uncertainty and risk. Pratney's best contribution is the joy of recognising in the complexity of creation the God that is known from the complexity of the Bible.[85]

Most of the people speaking fractally about church are from American non-denominational congregations. The majority of the writing concentrates on using fractals as a managerial tool for growth and fails to engage theologically with the process of growing church, making their contribution to the dialogue of fractals and Fresh Expressions somewhat thin. It is also notable that until fairly recently, America has not had any significant engagement with the Fresh Expressions movement. By

[85] Jonathan Bellamy, *Chaos mathematics, fractals and embracing change: Part 4 of a 4 part interview with Winkie Pratney, 2009*
http://www.crossrhythms.co.uk/articles/life/Winkie_Pratney_Chaos_mathematics_fractals_and_embracing_change/37166/p1/ (14 July 2014)

contrast, James Klass of the Network Church in Canada, seems to be the one voice in the wilderness using fractals as a theological tool for discipleship.[86]

Klaas talks about Social Learning Fractals, which are informal learning patterns that are intuitively copied and passed on to the next person or next generation.[87] They are inherent within human experience, from learning to get dressed in the morning through learning to ride a bicycle, to learning how to behave in various social situations. One of the strongest points in 'Fractals and Faith' is that Klaas draws the attention of the reader to current learning patterns in the church. Klaas points out that sermons do not normally function as a social learning fractal. The congregation does not hear a sermon, then go and preach a sermon. There are learned responses to hearing a sermon but often these are not the most helpful social learning fractals.[88] Seating patterns are often in straight lines facing the front and the learning pattern is passive listening.

Fresh Expressions are inherently geared up to consider different learning styles and active listening is part of the definition of the movement. Whilst leaders of Fresh Expressions may not yet be thinking in an explicitly fractal way, most of them naturally tend towards a teaching style that is more easily repeated by those who attend because it is drawn out of the culture it is speaking to, rather than imposed upon it.

[86] James Klaas, *Fractals and Faith Patterns for Learning in Discipleship,* (Kindle Edition, 2011)
[87] Klaas, *Fractals,* loc 40
[88] Klaas, *Fractals,* loc 247-254

One key issue that is addressed by fractals is that of scaling from small groups to large institutions. Klaas picks up this issue and notes that as the church scales up, it often moves from participation to passive learning[89] and rightly draws the reader's attention towards using God's resources for scaling up.[90] He states that '...we need to figure out what can't be changed in the church before we imagine what changes might occur. These essential components must be built into the DNA of the church so it becomes more self-organizing and self-reproducing.'[91] However, he does not go into great depth in this text about what these essential components ought to be.

Klaas engages with the idea that some aspects of discipleship are open to change but that the Gospel is the unchangeable kernel. However, Klaas goes on to say 'Each need to decide what part of the Gospel is an unchangeable discipleship pattern and what part adapts to culture.'[92] Klaas has perhaps missed some of the point here. The unchangeable fractal nature is iterated within the changeable context, so in some ways it is not a case of being able to separate out the changeable from the unchangeable, more a case of understanding what it is about an activity or a pattern of working that reflects some aspect of the Gospel. Not all Christians need to work with homeless people, but the drive that leads one Christian to work with the homeless, ought to be present in another Christian to work with children or struggling immigrants. Not all Christians need to sing hymns, but there is a need for all Christians

[89] Klaas, *Fractals,* loc 43
[90] Klaas, *Fractals,* loc 51
[91] Klaas, *Fractals,* loc 380-82
[92] Klaas, *Fractals,* loc 47

to find a way to voice their worship for God in some corporate context. The Gospel cannot be separated from context; rather it remains the same in itself and is iterated differently in the context. Jesus is perhaps alluding to this inseparable nature of gospel and context when he speaks of salt losing its saltiness;[93] salt is either tasted through the whole dish or it is absent from all of it.

Klaas talks about the importance of stories which use words efficiently for the message to be remembered more easily.[94] It is surprising that Klaas comes this close, without actually voicing the suggestion that parables are fundamentally fractal in nature. Parables possess precisely the story telling efficiency that is required to convey a simple message which has the largest possible capacity for iterative complexity in an infinitely large number of contexts. Efficiency in conveying a message is central to what makes fractals so fascinating and so useful for Fresh Expressions. Moreover this efficiency of communication seen in parables, is part of what gives Fresh Expressions a theological manifesto to take the fractal essence of Church and iterate it properly in as many contexts as possible.

In 'Fractals and Faith' Klaas attempts to shift the emphasis away from numerical growth and towards discipleship.[95] His ultimate aim in this text is 'that you begin to recognize fractal patterns and choose the best ones, that you better

[93] Matt 5:13
[94] Klaas, *Fractals*, loc 61
[95] Klaas, *Fractals,* loc 179-80

understand how your story fits into The Story, and that you are given wings as a learner of our Lord Jesus.'[96]

One approach to the application of fractals to theology and to ecclesiology is to take techniques learned from applying it to other disciplines and carry them wholesale over to a Christian context. An example of this would be to use the application of fractals to market economics; to gather as much data as we can about Church growth and decline and use fractal analysis of the graphs created by that data in order to identify ecclesiological behaviours and changes. This could be done by collecting the changing attendance statistics for a number of different congregations with different ecclesiologies, perhaps including more complex data than is usually collected from churches like age, gender and some wealth/poverty indicator. This data could be used to produce various graphs to be analysed both mathematically and visually, to see if any recurring patterns may be recognisable. Those patterns could then be used to assess which ecclesiologies are more or less successful in different situations.

This might be an interesting exercise and anyone who seeks to take on this or any similar endeavour should be commended for their effort, but it would be mathematically complex and inaccessible to the majority of Church goers. The primary danger of such an approach is rooted in the problem of basing findings on numerical success rather than the successful transformation of individuals and the dissemination of what might be called kingdom values. This process might help grow the church but

[96] Klaas, *Fractals,* loc 95

fail to give any indication of the quality of discipleship in those congregations and what their ultimate purpose or effect might be.

Perhaps a more useful approach for applying fractals to theology and ecclesiology is to apply fractal thinking directly into the theological tasks. A fractal image like the Mandelbrot Set cannot be made without a computer to process the large amount of numbers or without an understanding of imaginary numbers. However, the understanding of a tree in fractal terms as a trunk that splits into two branches, which splits into four and so on, is one that can be understood and visualised quite intuitively. This intuitive approach, which uses less number crunching, less high level mathematics and far more of the conceptual nature of fractals, can be applied to theology in a way that echoes other uses, but is far more specific and useful to this field of study. Moreover, the intuitive visual analysis to which Mandelbrot tried to draw the attention of the financial world, has the potential of being widely usable in normal church life.

A Definition

It is perhaps important at this stage to establish more specifically what might be meant by the phrase 'fractal theology'. Fractal theology is theology that behaves in a fractal manner. This includes ideas not yet thought of, as well as recognised aspects of the nature of God that can be, or perhaps unwittingly already have been described in a fractal way. There are a significant number of theological ideas and theories that have already been explored in the past, which contain fractal elements. Indeed there is in one sense nothing new in what is being put forward here. God is not changed by

the discovery of fractals; rather, the hope is that more may be revealed about the nature of God, by seeing God through fractal eyes.

Fractals in scripture

Many well known biblical passages that help to define the Christian faith can also be seen in a fractal way, though not all biblical passages or well known biblical statements are useful as fractal generators.

'You shall not murder'[97] is simple, but does not iterate in any particularly complex or interesting way. A person might choose not to commit murder, but this does not intrinsically change what happens the next time that person considers whether or not to iterate the command. They might think 'last time I did not commit murder and that went well for me so I shall do the same,' but the progression is linear and does not create something new from the repetition.

By contrast, bringing together the commands 'Love God with all your heart and all your soul and all your strength,'[98] with 'Love your neighbour as yourself'[99] as Jesus did in Matthew 22, creates a statement that has many complex fractal qualities.[100] Love in itself is a complex concept that is described with a simple word; a word that contains many cascading possibilities as described, at least in part, by Paul.[101] But in addition to this, the act of loving your neighbour as yourself changes the way you feel

[97] Ex 20:13
[98] Dt 6:5
[99] Lv 19:34
[100] Mt22:37
[101] 1 Co 13

about yourself; it changes the relationship with self and therefore changes the nature of the love given each time. Likewise the capacity to love God with all of heart, mind and strength is changed by the sense of self. Capacity for love and sense of self are intrinsically interlinked and therefore this statement changes in effect every time it is iterated because of the previous iteration, making this a deeply fractal statement. Matthew's Gospel concludes the quote with these words which suggest a consciousness of this fractal complexity, 'On these two commandments hang all the law and the prophets.'[102] So perhaps the greatest commandment is also the greatest fractal. It would be wrong to suggest that the Church is not aware of the hidden complexity that lies within this simple statement, yet we might ask if there is any evidence of the church seeking to observe and reflect upon the patterns created by the manifold iterations of the statement.

Many parables have an obvious fractal nature and have been used as such for centuries, but becoming aware of this fractal nature allows scope for deeper analysis. The parable of the sower shows God as the farmer sowing the seed of the Good News. The harvest is exponential in its increase, 30, 60 or 100 times what was sown.[103] But what happens next year? It is important to be careful how the metaphor is expanded from here; if the seed is thought of simply as food, then it is consumed and the cycle ends. However if the seeds are replanted next year then the crop continues to expand exponentially and fractally. Each year there will be a natural pattern of expansion with

[102] 1 Cor 22:40
[103] Mt 13:1-9

the factors of soil quality, rocks, birds, pathways and weeds helping to create limits for the fractal pattern that emerges.

It becomes far more interesting when the question is asked; where the individual believer is positioned within this parable? If the seed is the message, replicated many times then we should avoid thinking that next year the seed represents a new crop of believers. The different soil environments represent attitudes of people and not the people themselves. This picture is a highly abstract fractal that allows the listener to position themselves at every part of the fractal image including, to some extent, the sower. If this parable is considered in the context of the Church as the body of Christ,[104] then the people who have listened are able to engage in being part of the sower, but never individually or independently of Christ.

This can be linked to the vine and the branches as a fractal image.[105] God's spirit flows through the branches and feeds the branches that are rooted in Christ. As each new year of growth becomes established so the next year's fresh growth is fed, from the roots, through the established branches of the previous season.

Vines also have a specific biological quality that is often ignored by theologians. Vines are dependent on their circumstances, not just the weather and the amount of sunshine, but also structurally. Vines cannot grow without walls, fences and other plants to support them as they climb. This links directly with one of the central ideas of

[104] 1 Co 12:27
[105] Jn 15:5

Fresh Expressions; that God is already at work in the community and that the Church needs to engage with God through listening and responding to the culture.

The Bible has many passages that address the issue of human participation in God's work, and several of these help to describe the fractal nature of the kind of participation to which Christians are being called. One of the most powerfully fractal images in the New Testament is that of Jesus washing the disciples feet in John 13;

> [7] Jesus answered, “You do not know now what I am doing, but later you will understand.” [8] Peter said to him, “You will never wash my feet.” Jesus answered, “Unless I wash you, you have no share with me.”

It is fractal because the cleaning is a symbolically transformative act that can be repeated by the disciples. In verses 14-15 Jesus says, '[14] So if I, your Lord and Teacher, have washed your feet, you also ought to wash one another’s feet. [15] For I have set you an example, that you also should do as I have done to you.' Whilst Jesus obviously would not have known the word fractal, this is one of the clearest references that show an understanding of the kinds of repeated patterns seen in fractal geometry.

The washing of the feet is also fractal because Jesus comes with all the authority of God and then humbles himself to be below the status of his disciples. The disciples are both empowered to do the washing for themselves and are required to humble themselves to be below the status of anyone they bring to faith. If Jesus called his disciples to be humble without first humbling himself then there would be discontinuity. The pattern is one of servant leadership and whilst this may be iterated in an infinite number of ways, its inclusion is not expressed as optional. This role

reversal fractal is echoed in the phrase the first will be last and the last will be first.[106] It is also a fractal that Church frequently fails to apply particularly at a structural level.

Though there are many other fractals to be found within biblical text, it would be wrong to leave this chapter without saying something about a fractal theology of the cross. Hebrew's 7:27 speaks of Christ's sacrifice as forgiveness for sins, 'once and for all,' and yet clearly Christians still live with the burden of sin. If we consider the moment of the crucifixion to be a kind of fractal initiator of the universal lifting of the burden of sins that is slowly iterated out across all time and space, then that disparity becomes easier to visualise and to reconcile. The provisional nature of the salvation experienced in this life perhaps becomes more comprehensible in the light of this concept, but we will return to the lifting of the burdens of sin in the final chapter.

Fractal Theology has a tendency to resist the kind of labelling that has occurred in what might be called Euclidian Theology. Theology books are littered with technical words like soteriology, homoousias, sacerdotalism, ontological and so on. These words are short hand for concepts that are thought to be too large and complex to be stated in non-technical language. Fractal theology calls for a far greater efficiency of language than this. It calls for phrases and short stories which carry, without the need to attach complex meanings to individual words, all the information that is required to iterate deep divine concepts, from simple beginnings to highly complex endings. Here the often lofty world of theology might be placed back in the hands of the people who,

[106] Mt 20:16, Mk 10:31 and Lk 13:30

without degrees or diplomas might ask themselves, 'in this act, have I demonstrated love of God, neighbour and self; and how have things changed as a result?'

Chapter 5: Fractal Fresh Expressions of Church

The opening statement from the Fresh Expressions website says, "Fresh Expressions encourages and resources new ways of being church, working with Christians from a broad range of denominations and traditions. The movement has resulted in thousands of new congregations being formed alongside more traditional churches."[107] What it does not say, is why new ways of being Church are needed. Tom Stuckey, in his presidential address to the Methodist Conference in 2005 expressed this need in his prophetic statement; 'God is telling us to create fresh expressions of Church alongside and within the old since much of the old, in its resistance to change, will not survive.'[108]

In a perfect world, the whole Church would change at exactly the right speed, both to engage with the changes in culture and to retain the full and complete incarnation of the Gospel. However, the reality is that all Church is an imperfect and provisional echo of the Kingdom to which it points; it is a complex, multidimensional and flawed iteration of the simple truth which is the Gospel. The inherited Church has developed through times of much slower change than are currently being experienced in the western world. As a consequence the structures of traditional church are not built to cope with significant and rapid change. In addition, inherited church often carries with it unhelpful hangovers from imperialist culture and other bits of cultural

[107]Fresh Expressions, *Who are we?* http://www.freshexpressions.org.uk/ (22 July 2014)
[108] Stuckey, *Pentecost,* 1-2

baggage which are neither attractive to newcomers nor essentially part of the Gospel.[109]

Fresh Expressions are an intentional breaking and restructuring of ecclesiology in order to cope with the acceleration in the rate of change in Western Culture and to remove some of the cultural hangovers of the past, without losing the essence of what it is to be Church. This repeated pattern of discernment through breaking and restructuring deeply echoes the words of Paul in 1 Cor 11:29 when he speaks of 'discerning the body' before sharing in the Lord's Supper. The word 'discerning' is translated from the Greek διακρίνων, which literally means 'through breaking or separating'[110]; a clever play on words about the breaking of bread and the Church as the body of Christ.

One of the tensions between Fresh Expressions and inherited Church has been the question of whether Fresh Expressions are, can be or even wish to be sacramental, hence the writing of 'Fresh Expressions in the Sacramental Tradition.' In many ways, this book does an important job of calming the fears of the Anglo-Catholics and declares to all that Fresh Expressions take the sacraments seriously.[111] However, if Fresh Expressions are in the business of discerning what is fundamental to the faith and what is baggage, then they need to be free to ask the questions that inherited

[109] Goodhew, *Fresh,* 38
[110] "κρίνω" in Gerard Kittel (Ed) Theological Dictionary of the New Testament Vol III (Michigan: Eerdmans 1964) 921-2
[111] Steven Croft, "Persuading Gamaliel" in Croft and Mobsby, *Sacramental,* 42

church are unable to ask, such as how much of the Church's sacramental tradition comes from God's commandment and how much is cultural baggage.

If love God and love your neighbour as yourself is the greatest theological fractal then perhaps the institution of the last supper might be the greatest ecclesiological fractal. In my own analysis of Holy Communion, I have become aware of a sense in which the words of the institution constitute a fractal that has an immeasurable scope to be iterated as an ecclesiological pattern of breaking down, symbolised by the bread and pouring out, symbolised by the cup. It seems highly unlikely that the Church has found the limits of its possible iterations within inherited Church. Fresh Expressions have the opportunity to iterate this breaking down of the church as the body of Christ and pouring out of the Holy Spirit as a fundamental part of their structure.

Goodhew introduces the centrality of Fresh Expressions and pioneer ministry to the Christian tradition, by quoting 1 Cor 15:3-4 in which Paul speaks of handing on what he had received.[112] What Klaas suggests regarding sermons can be expanded to highlight a larger issue about fractal leadership. Pioneer ministry should be an intrinsic part of Fresh expressions, but pioneer thinking cannot remain exclusive to congregational leaders if Fresh expressions are to grow organically and be continually handed on. Notably the lack of pioneer thinking in inherited Church is perhaps

[112] Goodhew, *Fresh,* 1

indicative of choices of growth patterns that have failed to encourage pioneers within the Church.

If Fresh Expressions are to be fully Church then the Gospel needs to be observable and recognisable as being fractally present in all parts of that Church. Fresh Expressions should not be the inherited Church with a fresh veneer; neither should they be contemporary culture with the Gospel tacked on the top. They need to be the Gospel iterated fully in context, or at least as near as the limited capacity of humanity, with the limitless capacity of the Spirit can achieve together.

Some aspects of Church life may seem easy to label as superfluous. A church certainly does not need a video projector or a stained glass window to be Church, but there are those people for whom church is not Church without an organ, or pews. Finding a robust theology for Fresh Expressions requires the ability to pack down church in such a way that the essence can be moved to a new context without ever losing its incarnational reality. In the accounts of Jesus sending out the twelve[113] and the seventy or seventy two[114] he gives the instructions not to take money, a bag or sandals with them. There is a call here when engaging in the mission of the Church to travel light. Thinking fractally is perhaps the best way to achieve the task.

[113] Mt 10:5-15
[114] Lk 10:1-11

The theme for the 2014 Greenbelt Christian Arts Festival was Travelling Light,[115] this was in part rooted in the practical need for the festival to move to a new venue, but it also contained within it a deep theological sense of the need for the people of God to carry less baggage in order to travel more freely.

Matthew 11:28-30 says;

> 28 "Come to me, all you that are weary and are carrying heavy burdens, and I will give you rest. 29 Take my yoke upon you, and learn from me; for I am gentle and humble in heart, and you will find rest for your souls. 30 For my yoke is easy, and my burden is light."

These words make a theological link between the light travelling of the Gospel as carried by the disciples and the light burden of that Gospel in comparison to the burdens with which we meet God. Greenbelt's theme is evidence of that same theology being iterated at two separate dimensional levels based on lessons learned from previous festivals.

It is a common error for inherited church when considering some form of outreach or church planting, to separate out the structure and process from the pastoral. Yet the concept of the lifting of burdens in the light of the sending out of the disciples connects the pastoral and the process into the same fractal. It also co-opts the Jewish notion of forgiveness as seen through the Hebrew language. The Hebrew

[115] Greenbelt, *Travelling Light – our theme for 2014* http://www.greenbelt.org.uk/blog/2013/11/travelling-light-our-theme-for-2014/ (1 Sept 2014)

verb *nasa* נָשָׂא which we translate as forgive literally means to lift or carry;[116] forgiveness is connected with the lifting of burdens.

By reconnecting the structure, the theology and the pastoral in the essence of Church and iterating throughout the incarnated Church, the whole institution becomes a living manifestation of forgiveness and the lifting of burdens. Fresh Expressions are essential in taking up the baton of this restructuring, because more often than not the inherited Church is too encumbered by its own structures to implement this reintegrated theology within itself. What inherited church can do though, is allow the freedom for Fresh Expressions to implement new fractally integrated and healthy structures on its behalf.

New monasticism is a key aspect of Fresh Expressions with regard to thinking about a fractal theological approach that lifts burdens as it offers 'simplicity in a context of complexity'.[117] Essentially, New Monastics like Mobsby and the Moot community are seeking to iterate simple patterns seen in ancient monastic traditions, but re-contextualised in the current context. The desire to live more simply and to cause less damage is an attractive proposition for anyone searching for a different way of being Christian.

The question that perhaps Moot is not consciously asking is how that simplicity interacts with complexity; how it maintains its otherness without either becoming

[116] Francis Brown et al. *The Brown-Driver-Briggs Hebrew and English Lexicon* (Massachusettes: Hendrickson, 2010) 669
[117] Ian Adams and Ian Mobsby, "New Monasticism" in Steven Croft and Ian Mobsby, (Eds) *Fresh Expressions in the Sacramental Tradition* (London: Canterbury Press, 2009) 57

irrelevant or being swallowed up by complexity. Thinking fractally allows the simplicity to remain a core focus regardless of the depth of complexity into which a person or a community has wandered. At any point in the apparent chaos of the world, it ought to be possible for someone who has grown accustomed to thinking fractally to see everything in terms of the simple underlying principles.

Cordeiro's use of fractals in team building applies the concept of scaling, so that each team has five people; one is the leader, the other four can each lead a team of four. This can be iterated to many levels.[118] The back cover of 'Doing Church in a Team' tells us that New Hope Christian Fellowship has grown to more than 10,000 congregants. The strength of Cordeiro's fractal model is that it keeps the structure simple even though it is large, and prevents individuals from taking on overly large pastoral or administrative responsibilities. It also means that relationships are kept close and manageable in a situation where it would be easy to lose people in the crowd. It is important not to underestimate this move towards fractal thinking.

However, there seems to be no contingency in this simple concept for significant change, for death or times of decline. It is great for an expanding church but offers little by way of the potential for the complexity that is promised by fractals. More importantly it is an openly top down hierarchy that distributes tasks from leaders to helpers. It has no sense of the theology of 'the first shall be last' or 'washing the disciples' feet' embedded into the structure. Also, who looks after the person at

[118] Cordeiro, *Doing, 174-82*

the top of this hierarchy and what happens to the system if they burn out? Equally there is nothing here of the vine which embraces and relies upon its surroundings to thrive.

Cordeiro's use of fractals is somewhat reminiscent of the get rich quick plans of the economic world which Mandelbrot found problematic. Like the markets observed by Mandelbrot, the behaviour of congregations are usually harder to predict than is initially presumed and what looks like a risk free congregation often turns out to be full of volatile variables. Congregations have a memory of the past which affects their future behaviour; they display a corporate personality that is not the same as the sum of their individual parts. Congregations often display misleading patterns of growth or decline that is contrary to the true spiritual health of the discipleship and change happens quicker in volatile times, however resistant to change a congregation may be. Like the financial market, congregations and entire denominations are never static and live with a constant state of internal and external change at all levels. Homogeneity can often bring rapid growth followed by rapid crashes, whereas diversity often brings greater stability.

A strange phenomenon has been demonstrated by Michael Frame using the Sierpinski Triangle, whereby instead of beginning with a triangle he begins with a drawing of a cat and applies the iterative principles of the Sierpinski triangle to the cat.[119] At first the cats continue to look like cats, but as the image gets more detailed

[119] Frame, *Stories*, 6:39-7:20

the image of the cat is lost and is replaced by the Sierpinski Triangle. The same will surely be true of any Expression of Church; if the structure that replicates it has a particular inbuilt fractal theology, it will be that theology rather than the theology of the particular expression of Church that will prevail.

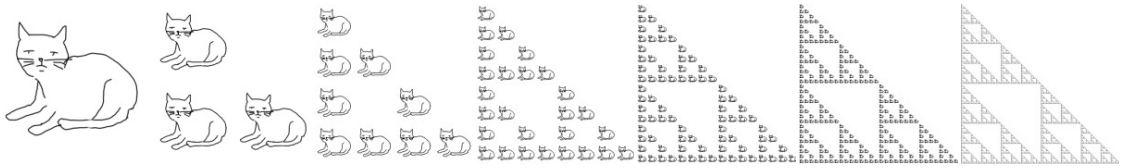


Figure 3 Replication of Frame's Sierpinski Cats

One common problem with Church structure, is that what begins with the turbulent nature of the spirit and a healthy capacity to embrace risk, quickly becomes a rigid institutionalised structure that is risk averse. There is perhaps a tendency to presume that Church is and ought to be a place of mild randomness, where there are minor inconsistencies but an overall stability and an unchanging nature to. In one sense the unchanging nature of God calls for an unchanging Church, but if the unchanging nature of God is a fractal type of self similarity, as God's work in creation would seem to suggest, then the kind of stability that we seek in Church ought to be the same. That is to say, the randomness ought to be wild and the unchanging nature of the church should maintain the same level of upheaval and transformation at all levels of Church life.

I recently asked several of my congregations what word they would use to describe a cat that isn't moving. At least one voice in every congregation was brave

enough to voice the word 'dead'. Even if a cat is sleeping there is still some movement, the reality is that at the most basic level life is movement and therefore the Church's obsession with remaining still and stable is a formula that can only result in death.

For Fresh Expressions to remain fresh they need to be not just fresh at the local level but also to share that Fresh outlook though the emerging structures. Mandelbrot recognised how markets were turbulent like the wind; fractal at many levels, and the church ought to be built on the turbulent nature of the Holy Spirit. So there is a need to think about how to allow turbulent and ever changing structures to develop without descending into chaos. The answer surely must be to use fractal theology like that described in chapter 4 to model fluid structures capable of withstanding change at every level.

Diagrams like the ones below begin to use fractal thinking to map out aspects of church life and church growth in ways that offer subtle but significant differences to the ways that people often think. The first set of diagrams are an attempt to describe the structure of the Methodist Church in a way that removes the concept of a top down structure, they also show that whilst the meetings at various levels of organisation may be separate, each of the parts of the Methodist Church come together to make up the whole and therefore there is no separate part that is the hierarchy.

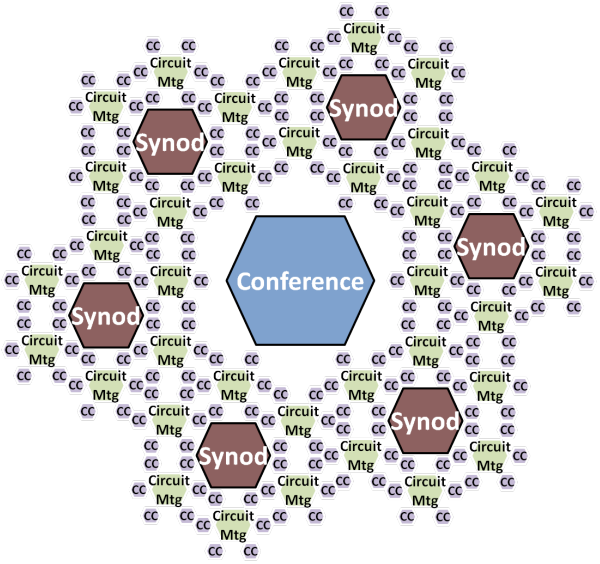
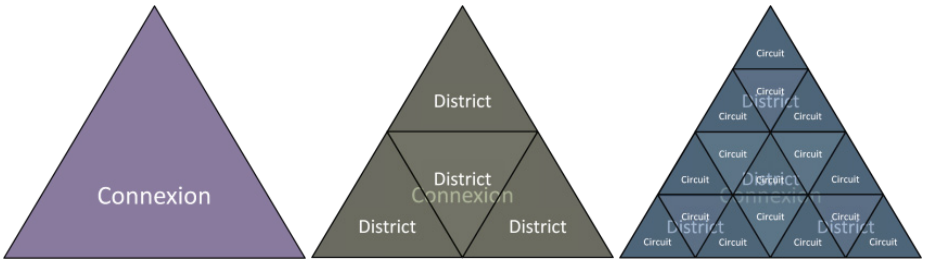


Figure 4: Fractal diagram of Methodist Meetings



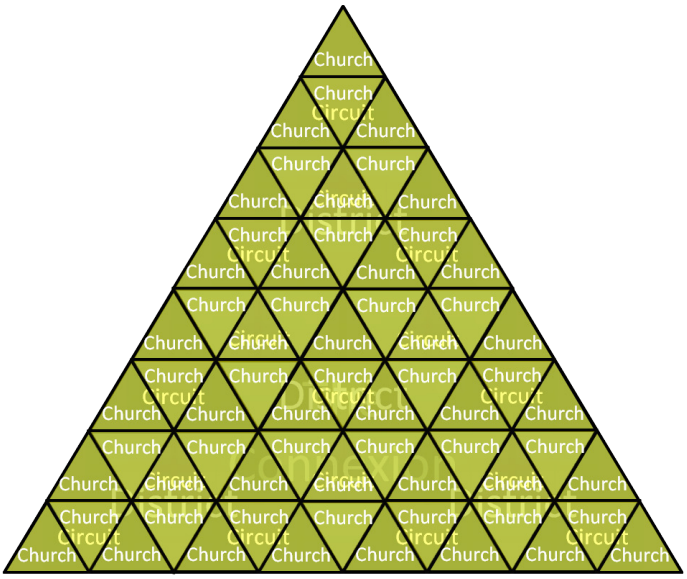


Figure 5: Fractal diagram of Methodist Church structure

Cell church has been shown to be one of the most successful forms of Fresh Expressions[120] and has its roots in the early Church as well as early Methodism. The following set of fractal diagrams offer a way of mapping the membership of a church into spaces that sub divide into groups like cells or classes, Methodist bands, and prayer triplets. It also contains a natural fluidity in a number of directions. Each triangle representing one person has the potential to subdivide into another twelve, but in addition each twelve has fluid edges that allow for small expansions and interactions within and beyond the membership of the congregation.[121]

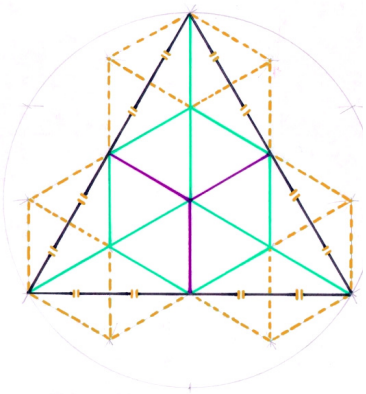


Figure 6: Brazier's Cascading Triangle (1st Iteration) A cell or class with 3 bands

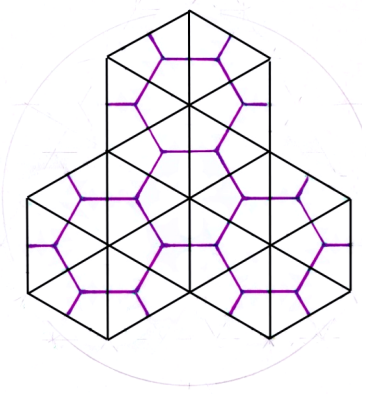


Figure 7: Between 1st & 2nd iteration; with prayer triplets

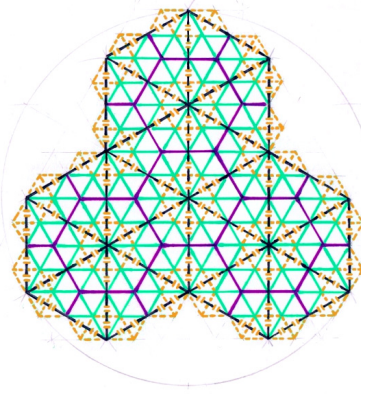


Figure 8: Brazier's Cascading Triangle (2nd Iteration)

The four following diagrams show one way that this fractal might be used to map a real congregation and explore ways of dividing the congregation into missional cells.

[120] Goodhew, *Fresh*, 64

[121] See Appendix 1 for the formula for this fractal

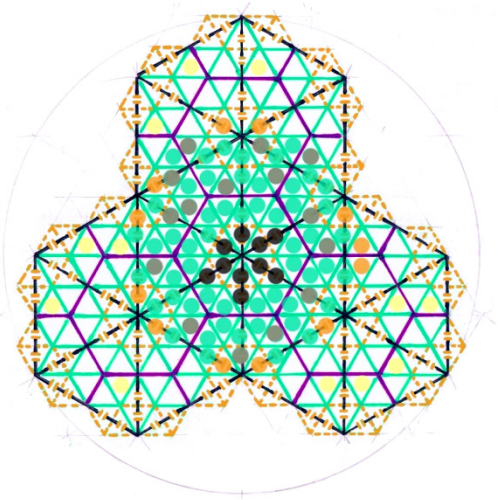


Figure 9: Random placement of adherents (oldest in the middle)

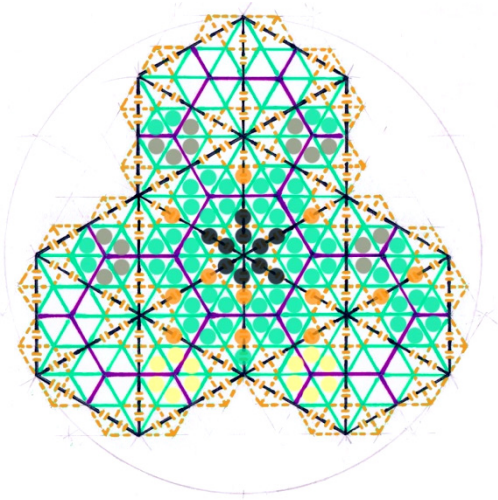


Figure 10: Adherents organised around stability and past members

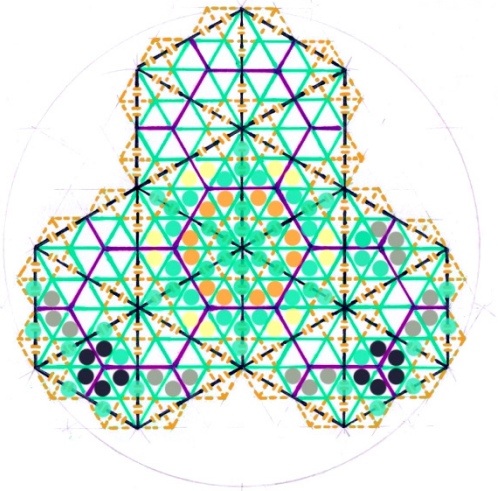


Figure 11: Adherents organised around peripheral attendance and supporting the bereaved

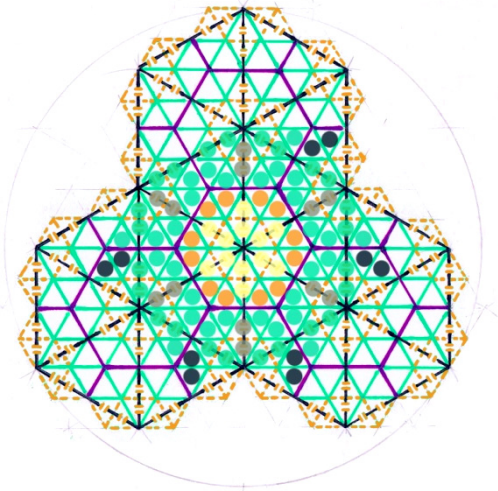


Figure 12: Iterating the concept of the first shall be last and the last shall be first

- Recently deceased
- No longer attending
- Attending members
- Attending non members
- Loosely connected

These diagrams are simply tools for describing what is already there, but the process of description is essential. It means nothing to say we are made in the image of God if we are not able to see that image; to trace its outline and describe its geometry. How we describe what we do is dependent on why we describe what we do

and therefore the language we use becomes a kind of geometry in itself, describing the shape of our intentions. The language of the treasurer's report to the church council will be naturally different from the language of the Churches mission statement. This returns to the concept of effective dimensions as described in chapter 2. To ask how a congregation is doing financially, engages with different dimensions than to ask how it is doing spiritually, emotionally, in terms of its numerical membership or of its social standing in the wider community. Yet if there is no crossover and no connection in the language it is probably an indication that the mission is not being iterated in all aspects of the organisation, and in addition it will most likely result in a failure to communicate both within and between the various expressions of Church.

Often, the stories told on the Fresh Expressions website[122] are encouraging, but lack a sense of clarity in how the theology is worked out and what the effective dimensions of the descriptions actually are. Deep theology already exists within Fresh Expressions but the freedom and skills need to be given to those at the heart of those congregations to speak accurately and effectively about what is being done; about their intentions, how and on what levels they were iterated, how reflections on the work done have informed practice and where God can be seen at work in the growth patterns of the ministry.

[122] 'Stories' http://www.freshexpressions.org.uk/stories (3 Sept 2014)

Though Mandelbrot's mathematical work took him into many fields, he saw himself as a story teller.[123] Frame says, 'The fractal description of an object is a story about how it grows.'[124] Unlike the more Euclidian static theology that has characterised inherited church, Fresh Expressions lend themselves to a theology that is inherently story based because of the desire to move into new places and iterate the Gospel in context. Telling the story of Fresh Expressions is an essential part of discerning its theology and in order to tell that story in an effective way it is essential that the story tellers are able to clarify the effective dimensions involved.

Conclusion

Fresh Expressions of Church are about the people of God on the move in a complex world and the language required to describe this movement needs to echo that complexity in a way that is comprehensible. Just as Euclidian geometry is no longer sufficient to describe the complex and ever changing nature of the world for scientists and mathematicians, so linear, static theology is no longer sufficient to describe the shape of a church that needs to be not just fresh in comparison to inherited church, but intrinsically fresh and turbulent in the image of the Spirit of God.

This is hopefully just the beginning of a deeper exploration of how Fractal Theology may begin to redraw the geometry that defines what it is to be Church. At the heart of fractal theology is the notion that however the context affects the outworking of the theology, that theology should remain not just the same, but

[123] Frame, *Stories,* 12:05-32
[124] Frame, *Stories,* 12:37-40

present and unchanged throughout the whole expression of church in that situation. Written into the nature or the DNA of that theology, should be the constant breath of change, movement, turbulence and life. If we separate the spoken and written language of Church from the language or geometry of action, the separate parts ought to tell the same story.

It may be difficult to iterate theology from a pure formula without some expertise, but by starting with a first level iteration it is easier to gain an intuitive sense of how a fractal might continue to be iterated. Likewise, if a theological illustration is iterated to too many levels it may be difficult to see the underlying fractal which may become entangled with the contextualization. This is the beauty of parables and sayings of Jesus which function as simple, first level iterations of fractal theologies.

The great opportunity with Fresh Expressions is that for the first time in centuries the primary focus is about reiterating Church from the ground up as understood by means of those first level iterations, yet not unmindfully of the more complex iterations of inherited church. There is a need to both decontaminate and decontextualise the ecclesiology of inherited church, but never to presume it can be reiterated without a context. There is a human desire to find static non fractal formulas. Yet when theology is seen as fractal we can begin to see the stories of human encounters with God in terms of the levels of iteration they are expressing and we can begin a deeper journey towards discerning which aspects are about the rich tapestry of context and which point towards the eternal and unchanging truths of the Gospel.

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Bible quotes taken from the New Revised Standard Version

Appendix 1: Formula for the Brazier Cascading triangle

1. ____ Begin with an equilateral triangle
2. ____ divide it into three by drawing a line from the middle of each side to the centre of the triangle.
3. ____ Divide each space within the triangle into four spaces by drawing a line from each of the corners to the centre of each space.
4. _ _ _ Where this creates an isosceles triangle, split the triangle from the middle of the longest side to the apex and add a reflection of that triangle or combine with triangles already present to create two equilaterals.
5. The resulting shape will consist of equilateral triangles, making it possible to repeat the process at the next level of scale.