The Mathematics of Timewave Zero

This article, written by Peter J. Meyer, first appeared as an appendix (pages 211-220) in *The Invisible Landscape* (2nd edition, HarperCollins, 1993) by Terence McKenna and Dennis McKenna. Although there are serious objections to the Timewave Zero theory considered as a scientific theory, the mathematics underlying the theory is sound. The theory may be explored in detail by use of the *Fractal Time* software.

It should be noted that the construction of the fractal timewave starting from the King Wen Sequence of I Ching hexagrams is a 2-step process. The first, described (obscurely) in Terence McKenna's Derivation of the Timewave from the King Wen Sequence of Hexagrams, consists in the construction of a set of 384 numbers. (This construction has been made explicit in a computer program written in C by the author, the WEN_GRPH Program.) The second, described in this article, consists in the construction of fractal function (which, when graphed, is *the timewave*) based on any set of 384 numbers satisfying certain properties, a set which might or might not be the numbers generated in the first step (thus allowing alternative timewaves).

1. General mathematical considerations

As usual, let the set of non-negative real numbers be denoted by $[0,\infty)$. Let $v(x)$ be any function $v:(0,\infty) \to (0,\infty)$ such that there exist positive real numbers c and d such that:

(1) for all x, $v(x) < c$, and
(2) for all $x < d$, $v(x) = 0$.

Then the function $f:[0,\infty) \to [0,\infty)$ defined below, where a is a real number greater than 1, is called a "fractal transform" of v().

$$f(x) = \sum_{i=-\infty}^{\infty} \frac{v(x * a^i)}{a^i}$$

Clearly this definition is equivalent to:

$$f(x) = \sum_{i=-\infty}^{\infty} (v(x/a^i) * a^i)$$

To show that f (x) is well defined we must show that f (x) exists for all $x >= 0$.

Let x be any element of $[0,\infty)$. By condition (1), for all i, $v(x*a^i) < c$, so

$$\sum_{i=0}^{\infty} \frac{v(x*a^i)}{a^i} < \sum_{i=0}^{\infty} \frac{c}{a^i} = c * \left[\sum_{i=0}^{\infty} \frac{1}{a^i}\right] = \frac{c*a}{a-1}$$

so the left-most sum exists. Since $a > 1$ there exists an integer n such that $x/a^n < d$, so for all $i > n$, $x/a^i < d$, so by condition (2) for all $i > n$, $v(x/a^i) = 0$.

Thus:

$$\sum_{i=1}^{\infty} (\, v(x/a\hat{\ }i) * a\hat{\ }i \,) = \sum_{i=1}^{n} (\, v(x/a\hat{\ }i) * a\hat{\ }i \,)$$

which clearly exists. Since

$$\sum_{i=-\infty}^{\infty} \frac{v(x*a\hat{\ }i)}{a\hat{\ }i} = \sum_{i=0}^{\infty} \frac{v(x*a\hat{\ }i)}{a\hat{\ }i} + \sum_{i=1}^{\infty} (\, v(x/a\hat{\ }i) * a\hat{\ }i \,)$$

f (x) exists.

As the first theorem of Timewave Zero mathematics we have:

Proposition 1: For all x >= 0, f (a*x) = a*f (x).
PROOF: Let x >= 0 then

$$f(a*x) = \sum_{i=-\infty}^{\infty} \frac{v(a*x*a\hat{\ }i)}{a\hat{\ }i}$$

$$= \sum_{i=-\infty}^{\infty} a * \left[\frac{v(x*a\hat{\ }(i+1))}{a\hat{\ }(i+1)} \right]$$

$$= a * \left[\sum_{i=-\infty}^{\infty} \frac{v(x*a\hat{\ }i)}{a\hat{\ }i} \right]$$

$$= a * f(x)$$ which completes the proof.

2. The mathematical definition of the timewave

The function that represents the timewave is essentially a fractal transform of a saw-tooth function. First we shall define this latter function.

Consider the following set of 384 natural numbers, traditionally known as the *data points* for the timewave:

0,	0,	0,	2,	7,	4,	3,	2,	6,	8,
13,	5,	26,	25,	24,	15,	13,	16,	14,	19,
17,	24,	20,	25,	63,	60,	56,	55,	47,	53,
36,	38,	39,	43,	39,	35,	22,	24,	22,	21,
29,	30,	27,	26,	26,	21,	23,	19,	57,	62,
61,	55,	57,	57,	35,	50,	40,	29,	28,	26,
50,	51,	52,	61,	60,	60,	42,	42,	43,	43,
42,	41,	45,	41,	46,	23,	35,	34,	21,	21,
19,	51,	40,	49,	29,	29,	31,	40,	36,	33,
29,	26,	30,	16,	18,	14,	66,	64,	64,	56,
53,	57,	49,	51,	47,	44,	46,	47,	56,	51,
53,	25,	37,	30,	31,	28,	30,	36,	35,	22,
28,	32,	27,	32,	34,	35,	52,	49,	48,	51,
51,	53,	40,	43,	42,	26,	30,	28,	55,	41,
53,	52,	51,	47,	61,	64,	65,	39,	41,	41,
22,	21,	23,	43,	41,	38,	24,	22,	24,	14,
17,	19,	52,	50,	47,	42,	40,	42,	26,	27,
27,	34,	38,	33,	44,	44,	42,	41,	40,	37,
33,	31,	26,	44,	34,	38,	46,	44,	44,	36,
37,	34,	36,	36,	36,	38,	43,	38,	27,	26,
30,	32,	37,	29,	50,	49,	48,	29,	37,	36,
10,	19,	17,	24,	20,	25,	53,	52,	50,	53,
57,	55,	34,	44,	45,	13,	9,	5,	34,	26,
32,	31,	41,	42,	31,	32,	30,	21,	19,	23,
43,	36,	31,	47,	45,	43,	47,	62,	52,	41,
36,	38,	46,	47,	40,	43,	42,	42,	36,	38,
43,	53,	52,	53,	47,	49,	48,	47,	41,	44,
15,	11,	19,	51,	40,	49,	23,	23,	25,	34,
30,	27,	7,	4,	4,	32,	22,	32,	68,	70,
66,	68,	79,	71,	43,	45,	41,	38,	40,	41,
24,	25,	23,	35,	33,	38,	43,	50,	48,	18,
17,	26,	34,	38,	33,	38,	40,	41,	34,	31,
30,	33,	33,	35,	28,	23,	22,	26,	30,	26,
75,	77,	71,	62,	63,	63,	37,	40,	41,	49,
47,	51,	32,	37,	33,	49,	47,	44,	32,	38,
28,	38,	39,	37,	22,	20,	17,	44,	50,	40,
32,	33,	33,	40,	44,	39,	32,	32,	40,	39,
34,	41,	33,	33,	32,	32,	38,	36,	22,	20,
20,	12,	13,	10						

These values are derived from certain transformations performed upon a set of 64 numbers, the numbers of lines that change from each hexagram in the King Wen sequence to the next, as explained previously in this book. They provide the basic numerical values used in this mathematical definition of the timewave.

Define w(i) as the ith value of this set, using zero-based indexing. Thus:

i	0	1	2	3	4	...
w(i)	0	0	0	2	4	...

Extend w to a function w1() such that for any non-negative integer i, w1(i) = w1(i mod 384), where i mod 384 is the remainder upon division of i by 384. Thus, for example, w1(777) = w(777 mod 384) = w(9) = 8. w1() is a discrete function defined only for integers, not for all real numbers.

Now for any non-negative real number x, let v(x) be the value obtained by linear interpolation between the values w1(int(x)) and w1(int(x)+1), where int(x) is the integral part of x. Formally v(x) is defined as

$$w1(int(x)) + (x - int(x)) * (w1(x+1) - w1(x))$$

or in expanded form:

$$v(x) = w(int(x) \bmod 384) + ((x - int(x)) * \\ (w (int(x + 1) \bmod 384) - w (int(x) \bmod 384)).$$

Now consider the fractal transform f (x) of v(x) using a = 64, as follows:

$$f(x) = \sum_{i=-\infty}^{\infty} \frac{v(x*64^\wedge i)}{64^\wedge i}$$

or, what is the same thing,

$$f(x) = \sum_{i=-\infty}^{\infty} (v(x/64^\wedge i) * 64^\wedge i).$$

The function f (x) exists because

(1) for all x, v(x) < 80, and
(2) for all x < 3, v(x) = 0.

The fractal function t(x), which represents the timewave, and which is graphed by the software, is a simple transformation of f (x), as follows:

$$t(x) = \frac{f(x)}{64^3}$$

where x = time in days prior to 6 A.M. on the zero date*. The scaling factor of 64^3 is used so as to produce convenient values on the y-axis of the graph.

Thus the value of t() at 6 A.M. on the zero date is

$$t(0) = \frac{f(0)}{64^3} = 0.$$

The value of t() at 6 A.M. on the day before the zero date is

$$t(1) = \frac{f(1)}{64^3} = 0.000003616015I.$$

The value of t() at 6 P.M. on the day ten days before the zero date is

$$t(9.5) = \frac{1}{64^3} * f(9.5) = 0.000047385693$$

and the value at 6 A.M. on the day 1,000,000,000,000 days (about 2,737,888,267 years) before the zero date is 5,192,046.655436.

These values are independent of the actual zero date. The value of the timewave at any point in time is not a function of that temporal location itself but rather of the difference between that time and the time assigned to the zero point of the wave.

* The timewave is zero only at one point, when x = 0. For x > 0 the value of the wave is positive. The zero point is the point in time chosen to correspond to the value 0 for x. The usual point used is 6 A.M. on December 21, 2012 (known as the zero date). Thus the timewave has a positive value for all points in time prior to the zero date, is zero only at the zero point, and is undefined after the zero point.

Note that the "direction" of the graph is the opposite of what is usual with Cartesian coordinates. The graph of a function f(x) normally proceeds from left to right along the x-axis for increasing x. In this case the graph proceeds from right to left for increasing x, that is, for increasing number of days *prior* to the zero point.

3. The mathematical basis of resonance

The phenomenon of resonance, whereby regions of the wave at widely separated intervals may have exactly the same shape, is a remarkable feature of the timewave. The mathematical basis for this phenomenon is as follows:

Consider a point in time x days prior to the zero date, then the value of the wave at that point is t(x), as defined above. Now consider the value, t(64*x), of the wave at the point in time 64*x days prior to the zero date. From the result proved at the end of Section 1 above we have that

$$t(64*x) \;=\; \frac{f(64*x)}{64\text{^}3} \;=\; \frac{64*f(x)}{64\text{^}3} \;=\; 64*t(x).$$

Thus the value of the wave at a point B, 64 times as distant from the zero point as a point A, is 64 times the value of the wave at A. Since this is also true for the points in the neighborhoods of A and B, it is thus clear why a region around B has the same shape as a region around A.

This resonance is called the first higher major resonance, since the region around the point C, 64*64 times as distant from the zero point as the point A, is also resonant with the region around A and constitutes the second higher major resonance of point A. There are an unlimited number of higher major resonances.

Similarly for any point x, t(x/64) = t(x)/64, and so the value of the wave at a point B, 64 times closer to the zero point than a point A, is 1/64 the value of the wave at A. Thus the region around B has the same shape as the region around A, and thus constitutes the first lower major resonance of the region around A. As with higher resonances, there are also second, third, fourth, and so on, lower major resonances to any region of the graph. The lower major resonances are compressed geometrically toward the zero point, so that only a few seconds may separate the nth and the (n+1)th major lower resonances for some, not particularly large, value of n.

4. Further mathematical results

The mathematics of Timewave Zero extend considerably beyond the initial proposition proved above.*

Lemma 1: For any natural number x, v(x) = w(x mod 384).
PROOF: This follows from the definition of function v(), since for a natural number x = int(x) and so x − int(x) = 0.

Lemma 2: For any natural numbers x and i, v(x/64^i)*64^i is a natural number.
PROOF: By the definition of function v():

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v(x/64^i)*64^i = 64^i * w(int(x/64^i) mod 384)
                 + 64^i * ( x/64^i − int(x/64^i) )
                 * ( ( w(int(x/64^i + 1) mod 384)
                 − w(int(x/64^i) mod 384) )

               = 64^i * w(int(x/64^i) mod 384)
                 + ( x − 64^i*int(x/64^i) )
                 * ( ( w(int(x/64^i + 1) mod 384)
                 − w(int(x/64^i) mod 384) )
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* The mathematical results presented in the remainder of this appendix are based partly on work done by Klaus Scharff of Bergisch-Gladbach, Germany. Appendix V of the manual for Timewave Zero presents these results in relation to certain trigramatic resonances discovered in the timewave.

Since the values of the function w() are natural numbers, and x is a natural number, the value of this expression is a natural number.

Lemma 3: For any natural number x that is divisible by 3

$$f(x) = \sum_{i=0}^{\infty} v(x/64\text{^}i)*64\text{^}i + w(x*64 \bmod 384)/64.$$

PROOF: Suppose x is a natural number divisible by 3. By the definition of f(x) above:

$$f(x) = \sum_{i=-\infty}^{\infty} v(x/64\text{^}i)*64\text{^}i$$

$$= \sum_{i=0}^{\infty} v(x/64\text{^}i)*64\text{^}i + \sum_{i=1}^{\infty} v(x*64\text{^}i)/64\text{^}i$$

$$= \sum_{i=0}^{\infty} v(x/64\text{^}i)*64\text{^}i + \sum_{i=1}^{\infty} w(x*64\text{^}i \bmod 384)/64\text{^}i$$

by Lemma 1, since x*64^i is integral. Thus f(x) =

$$\sum_{i=0}^{\infty} v(x/64\text{^}i)*64\text{^}i + w(x*64 \bmod 384)/64 + \sum_{i=2}^{\infty} w(x*64\text{^}i \bmod 384)/64\text{^}i.$$

Since x = 3*y for some natural number y

$$\sum_{i=2}^{\infty} w(\mathrm{int}(x*64\text{^}i) \bmod 384)/64\text{^}i = \sum_{i=0}^{\infty} w(3*y*64\text{^}2*64\text{^}i \bmod 384)/64\text{^}i$$

$$= \sum_{i=0}^{\infty} w(384*y*32*64\text{^}i \bmod 384)/64\text{^}i$$

384*y*32*64^i mod 384 is 0, and w(0) = 0, so each term in this sum is 0.

Thus $f(x) = \sum_{i=0}^{\infty} v(x/64^i)*64^i \ + \ w(x*64 \bmod 384)/64$. QED

Proposition 2: For any natural number x that is divisible by 3 there is a natural number k such that f(x) = k/64.
PROOF: Let x be a natural number divisible by 3 then by Lemma 3

$$f(x) = \sum_{i=0}^{\infty} v(x/64^i)*64^i \ + \ w(x*64 \bmod 384)/64.$$

By Lemma 2 each term in this sum is an integer, so the sum is an integer, and so is an integral multiple of 1/64. The second term in the sum is also an integral multiple of 64, and so f(x) is.

On the basis of Proposition 2 we have:
Corollary 1: For any natural number x that is divisible by 3 there is a natural number k such that t(x) = k/64^4.
PROOF: Since t(x) = f(x)/64^3.

Proposition 3: For any natural number x that is divisible by 384 there is a natural number k such that f(x) = 64*k.
Proof: Let x be a natural number divisible by 384, then x is divisible by 3 so by Lemma 3:

$$f(x) = \sum_{i=0}^{\infty} v(x/64^i)*64^i \ + \ w(x*64 \bmod 384)/64.$$

Since x is divisible by 384, x*64 mod 384 is 0, so w(x*64 mod 384)/64 = w(0) = 0, so

$$f(x) = \sum_{i=0}^{\infty} v(x/64^i)*64^i \ = v(x) + \sum_{i=1}^{\infty} v(x/64^i)*64^i.$$

Now x is integral, so v(x) = w(x mod 384) = w(0) = 0, so

$$f(x) = \sum_{i=1}^{\infty} v(x/64\text{^}i)*64\text{^}i.$$

Since x is divisible by 384 there is some natural number k such that x = 6*64*k, so

$$f(x) = \sum_{i=1}^{\infty} v(6*64*k/(64*64\text{^}(i-1)))*(64*64\text{^}(i-1))$$

so
$$f(x) = 64 * \sum_{i=0}^{\infty} v(6*k/64\text{^}i)*64\text{^}i.$$

Now by Lemma 2 each term in the sum is a natural number, so the sum is, so there is a natural number k such that f(x) = 64*k. QED