Part V: A. Harmonic Analysis and the Nature of Space

Danny and I were in a paddle boat that we took out into the Bay. We were a tiny fish in a big sea feeling every wave out there from the tiniest ripple to the overpowering wake of the massive boats. The space we existed in was not flat, it was wavy. In our moment of insight we convinced ourselves that space itself is wavy and that waves should be the base unit to measure and construct with rather than yardsticks and atoms. It was the summer of '83 and such thoughts were a much needed escape for the insatiable hearts of the young men.

Harmonic Analysis does not prove that we exist in a world where the base unit is actually a wave. It is simply a mapping relation for modeling physical phenomena.

B. Conclusion

The fundamental constants *e* and π have irrational values but can be expressed as an infinite sum of rational numbers. Nature must have a method to provide these values so they can be used in natural phenomena. They cannot be left to chance.

This method has proven difficult to uncover. There are not enough spatial variables available to operate the mechanics needed to produce these constants. The same is true of other natural relations like the Fibonacci series. Our analysis suggests a shadow space that is virtual and unobservable. Natural constants and functions that need hidden variables rely on this virtual space for their underlying mechanics. The invisibility of this virtual space is precisely why these problems have gone unsolved.

There is an equivalence relation between real space and virtual space. Observers from both spaces must agree on the result of a common event. Therefore the results of mapping data in one space must agree with the results of mapping the same data in the other. Mathematically we would say that the integrals of the data maps over common boundaries are equal.

The equivalency of spatial mappings is not intuitive. We presented two examples that are easy to visualize. In the theatre problem the audience views complex motion in time space while the stage hand sees the same motion mapped in frequency space. The balloon problem is similar. Here the balloonist can only detect motion along one axis, while at the river it is apparent that wave action is causing motion in two dimensions. In both cases it is difficult for an observer to understand the alternate mapping. It is just not intuitive.

The base units in harmonic space are wave functions which are harmonically ordered, increasing in frequency and decreasing in amplitude. They can be thought of as vibration modes. There are an infinite number of these wave functions available, and, like a baking recipe, any amount of each individual component could be used. Therefore combining the wave functions to correctly map a natural phenomena requires a key or coding pattern dictating which components to use and how much of each. The component waves must combine in an exact way to produce a specific mode, somewhat analogous to an orchestra producing a specific sound.

The coding pattern is determined by the equivalence relation. The equivalence relation is a differential equation in integral form and has a solution set made from the base waves. The coefficients of this solution set are the coding pattern. They indicate which component waves to use and how much of each are necessary in order to meet the requirement that the equivalence relation demands: the results of both spatial maps must agree.

The coding pattern is a rule set. It requires the waves to combine in a certain way that results in equivalence with a physical action. That is how we determined the harmonic functions, through graphical equivalence.

The inverse is true as well. The physical action must equally comply with the rules that govern this harmonic combination. That is how nature provides the missing information for the fundamental constants and natural equations. The harmonic waves themselves are not observable in real space. It is their coding patterns required for equivalence which determines the values we observe.

The harmonic combination rules are precisely the type of rule sets that nature needs to control certain natural phenomena, but these rules are unavailable with the limited selection of real space variables. Instead there is an equivalence relation marrying real space to this harmonic space. Harmonic space is complex and needs combination rules to map an action. In doing so the virtual system provides the missing information in a seamless and invisible way.

This is nature's method of storing hidden values and implementing them. It works similar to a guitar string. The guitar string can only make certain tones. These are determined by a differential equation involving the physical properties of the string and its end conditions. If we build another string using the same equation we will get the same note. The string and its equation store information (the note). When it is plucked the string must obey the differential equation, and implementing this equation releases the stored information. The equivalence relation works in the same way. The value of π for example is stored in a differential equation involving the physical properties of the circle and its boundary conditions. When an action involving π occurs the solution of the differential equation (GTE) is called upon and the stored information is released. This requires the physical process to occur in a specific way analogous to the guitar string vibrating in a specific mode. So the value of π is not a geometry problem after all. It is a coding problem. The value of π is stored in the harmonic coding pattern that satisfies the equation. It is there for all to use for all of time just like the rules governing musical instruments.

When we examined the Euler Equation we saw that it was an example of a single spinner. In the π analysis we extended this model to two synchronized spinners. This enables control of two complex numbers with one variable, and the difference between these values provides the code. The Fibonacci Series is similar. Here two numbers are also controlled by one variable. They contain the information on the current value and the next value for each cycle, and therefore encode the value at every cycle in a single equation.

Nature relies on these coding patterns and there is an analysis method available to decode them. In doing so we can provide a better understanding of the underlying mechanics of natural phenomena.

C. Ubiquity

A single equation, the GTE, was used for determining e, π and the Fibonacci numbers. In general it provides a method for nature to encode and to store additional variables when insufficient real variables exist for natural phenomena. It also provides a transformation relation so that one set of data can imply the existence of another set of data.

We expect this work to have applications in many other fields.

D. Dedication

This work is dedicated in memory of our fallen brother and mentor Mike Chavez. The general transformation equation shall be known as The Chavez Equation.

E. References

1. What Makes an Equation Beautiful, The New York Times, October 24, 2004