Tantrix and the Yi Jing:

A Correlation of Binary Systems in Color

by

Jay Dunbar, Ph.D.

"'But we are running out of colours,' said Mr. Violet, intervening. 'That cannot be the case,' said Mr. White. 'There is an infinite number of colours.' 'But there are not that many names,' said Miss Taupe. 'That is not possible. A colour must have a name.' 'We can find only one hundred and three names for green before the colour becomes noticeably either blue or yellow,' said Miss Crimson. 'But the shades are endless!' 'Nevertheless, the names are not.'"
-- Terry Pratchett, The Thief of Time

Revised August 2009

Table of Contents

List of Figures

List of Tables

Introduction

Two binary systems: one of the oldest books in the world, dating back in written form some three thousand years, and a popular tabletop and on-line tile-laying game invented in the 1980's. As it happens, there is a compelling relationship between the two, and a one-to-one correspondence can be deduced between the tiles of the game and the patterns that form the symbolic matrix of the book. In this article I chart the connections as I see them using a third binary system: the electromagnetic waves of the visible light spectrum. I also propose a new method of consulting the ancient classic. I hope that fans of the game will find this fascinating, and perhaps delve more deeply into the book; and that scholars and devotees of the book might appreciate the insights that spring from fresh imagery—they may even enjoy the game!

<div align="center">

With respect and appreciation for both,
let us begin an exploration…

</div>

The Book...

The book is the *Yi Jing* (also commonly romanized *I Ching*) the Chinese "Book of Changes." Based on ancient cosmology, it is a crystallization in text and symbols of the defining worldview of Chinese culture, augmented by over 2,500 years of lively commentary. Throughout its history it has served as oracle, daily advisor, and source of wisdom for people in all walks of life: emperors and soldiers, merchants, priests, scholars and householders. The core of the book is a set of sixty-four six-line patterns (hexagrams) that represent the numbers from zero to 63 in base-2, the binary system: *lingua franca* of modern information technology. Leibniz, who "discovered" the binary system in 17th century Europe, is said to have been astonished, upon being given a copy of the *Yi Jing*, that the Chinese had been familiar with binary numbering for nearly three millenia.

Each line in every *Yi Jing* hexagram may be either "yin" or "yang" in nature: the "0" and "1" of the binary system. In the *Yi Jing*, a solid, unbroken line (——) is the symbol for yang, the positive, expanding force; a line with a break in the middle (– –) is the symbol for yin, the negative, contracting force. These two forces are called *taiji*: the great extremes, often pictured as halves of a circle, a backward S-curve gracefully bisecting it, a dot of one within the other showing that each creates its opposite (see Fig. A). Yin and yang are polar absolutes: the peaks and troughs in the carrier wave of being.

Yin and yang are also relative terms, referring to the contrasting elements of any dyad. They can refer to cold and hot, low and high, soft and hard, empty and full, wet and dry, shadow and light, etc.; nothing is *absolutely* yin or yang from this perspective: what is yang in relation to one thing will be yin in relation to another, and everything has its complementary yin and yang aspects.

We perceive and know through contrast and differentiation. Were it not for dark we would not know light, were it not for silence we would not know sound, were it not for rough we could not know smooth. Our senses are attuned to difference, for we are binary beings in a binary world, although we live in a very narrow band of total reality. The visible light spectrum, for example, which represents all that we can see and is the basis of this study, is a paper-thin section of the vast continuum of electromagnetic radiation. Yet though we cannot see as well as an eagle nor hear as well as a bat, our senses permit us infinite distinctions.
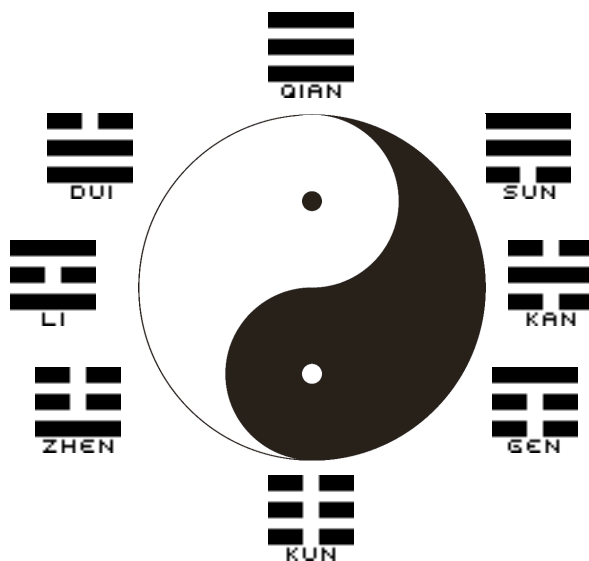
Figure A: *Taiji Diagram Surrounded by Trigrams in the Pre-Heaven (*xian tian*) Arrangement*.

The *Yi Jing* is a dynamic model of all that is. In concise text and evocative images, it helps us interpret the subtly-shaded intermingling of yin and yang within every situation. It counsels us to act effectively or wait strategically according to the requirements of the time so as to preserve our equanimity amid a complex web of tendencies and tensions. The Great Treatise tell us: "The Book of Changes contains the measure of heaven and earth; therefore it enables us to comprehend the tao of heaven and earth and its order." (*Wilhelm YJ* p. 293). Wilhelm, the original translator of the well-known Princeton edition, explains:

> "This… sets forth the mysterious connections existing between the reproductions given in the Book of Changes and reality. Since the book presents a complete image of heaven and earth, a microcosm of all possible relationships, it enables us to calculate the movements in every situation..." (*Wilhelm YJ* p. 293)

If there were only yin and yang, broken and solid lines, the book would seem fixed and static. But through two further lines, known as "sixes" and "nines," the *Yi Jing* is able to represent *change*: the fact that yin may (and does) become yang, and yang may (and does) become yin. The "six" is a yin line, but it is old: yang is growing within it. It is symbolized by a broken line with an "x" marking the middle (–x–), an indication that it will soon fill in and become a solid line. I call this line "yin becoming yang." The "nine" is a yang line, but it is old: yin is growing within it. It is symbolized by a solid line with a circle around its center (–o–), an indication that it will soon separate and become a broken line. I call this line "yang becoming yin." The

changing lines permit the book both to reflect the fluid nature of reality and to tailor its responses to diverse questions in a sentient manner.

The *Yi Jing* is a divinatory aid, not showing us the future but helping us see the present with greater clarity, often affording us a surprisingly lucid view of ourselves in its wise and ancient mirror. Many believe there is a personality or presence behind the book: an *oracle*. To some who consult it regularly, its particular genius is known as "the little old Sage in the yellow robe" (in antiquity the book was wrapped in yellow ox-hide). The Sage relates to the earnest reader with perspicacity and humor: sometimes kind, sometimes curt, like a revered teacher or grandfather. There is no doubt that the book has the ability to reveal subtle tendencies within the moment, currents in the flow, and can function as a trusted river guide to help us safely navigate the treacherous places.

The Game…

The game is Tantrix: a challenging tile-laying game invented in 1987 by New Zealander Mike McManaway. The tiles are six-sided, each side connected to one other side by a colored line. There are four colors in the 56-tile "Game Pack:" blue, green, yellow, and red, though only three appear on any one tile (as each colored line connects two of the six sides). Consequently, there are four Tantrix "suits" of fourteen tiles each. As distinctive as spades, hearts, diamonds, and clubs, the suits are easily recognized by their three-color combinations: B-G-Y (Blue-Green-Yellow: "No Red"), B-G-R (Blue-Green-Red: "No Yellow"), B-Y-R (Blue-Yellow-Red: "No Green"), and G-Y-R (Green-Yellow-Red: "No Blue").

Figure B: *Sint Tile and Hexagram*.

There are three kinds of colored lines: *corners*, *bends*, and *straights*. "Corners" connect adjacent sides of a tile with a 120° arc; "bends" are 60° arcs connecting two sides separated by a single intervening side; "straights" connect opposite sides. One or two of these line types appear on each of the fifty-six tiles, forming four different patterns: *Ronds*, *Brids*, *Chins*, and *Sints* in official game nomenclature. When three tiles join so as to link three corners of the same color, they form the smallest loop possible in the game; so the eight tiles containing three corners were named "Ronds," short for "roundabout:" a relatively tight circle in a road designed to control traffic. Twelve tiles, known as "Brids," contain two corners and one straight. Brids take their name from the idea that the pattern resembles an arched bridge (ála Picasso, since the bridge is seen from both sides at once).

The most numerous pattern, found on twenty-four tiles known as "Sints," contains one corner and two bends (Fig. B). Sint, short for "single intersection," prosaically indicates that the pattern contains two bends that intersect. Turn this tile so the corner opens upward and you may see a landscape with the sun rising or setting above folded hills.

The remaining twelve tiles in the Game Pack contain two bends and one straight. This pattern is called "Chin," short for "Chinese character" (Fig. C). Indeed, if we orient the tile so that the straight appears vertical, it resembles the primitive (*gu wen*) character for a tree: *mu*, the two bends depicting roots and branches. But if we take into consideration the circumference of the tile itself, another character is suggested: *kun* 困, representing a tree encircled. *Kun* is the name of *Yi Jing* hexagram 47, "Exhaustion," and indeed, *kun* means weariness or fatigue. Harbaugh's modern Zhongwen dictionary says the character derives from an image of a "tree growing in a ruined enclosure," and Wieger, in his classic work <u>Chinese Characters</u> (1915), says it refers to a camping spot under a tree, a place to stop and rest. Might there be a story here?

> *"A traveler, weary after a day of hiking, has stopped to rest at a place where a tree, an ancient araucaria pine, has grown up within the crumbling walls of a ruined inn, a waystation for travelers long ago. The tree now extends the hospitality once offered by the inn: the cool shadow of its branches a welcome refuge. The tree's great age is a measure of the centuries since the building was inhabited. The traveler camps beneath it for the night, and in his dreams strange pathways twist and intertwine, some straight, some looping gracefully like the branches moving above him in the dark. In the morning the dream remains, vivid, tantalizing…*

Figure C: *Chin Tile and Hexagram*.

The idea for the Mind Game, the prototype of Tantrix, came to Mike McManaway in South America as he recovered from a climbing fall in Patagonia, home of the araucaria pine, known as the "monkey puzzle tree." Perhaps this tree, with its strangely curving branches, provided some of the inspiration for the game? Taking another look at the Chinese character *kun*, a tree in an enclosure, we find that it combines with other characters to form *kunnan*, difficult; *kunhuo*, perplexed, baffled; and *kunrao*, to puzzle…

In the game of Tantrix, players connect tiles in an expanding design until all the tiles are played, each player trying to make the longest line or the largest loop of their chosen color. A complete

description of the game is outside the scope of this study: I refer interested readers to **www.tantrix.com**, where you may play the game on-line with robots or with other real players from around the world). There is a good balance of luck and skill in the two-player game: enough luck to encourage beginners and enough skill to challenge experienced players. Luck plays a larger role in games between three or more players, as so much can change before your turn comes around again, so tile placements become more isolated and less parts of an overall strategy.

Be that as it may, multiplayer games in a social (non-competitive) setting have a cooperative aspect: I find it enjoyable simply to watch the "tantrix" pattern emerge, and have enjoyed team games with six players, each with a "hand" of four tiles instead of six. A solitaire version can be played with a single suit of fourteen tiles, and there are also a raft of line and loop puzzles to be solved.

Apart from the challenge and fascination of the puzzles and the game for mature (and maturing) strategists and those willing to work on pattern-recognition skills, Tantrix possesses a deeper attraction. Maybe there is a connection, tucked back in the brain, with the colorful toys that hung over our cribs, that we teethed on as infants and played with as toddlers. Maybe it is the buttery feel of Bakelite: warmer, softer, and friendlier to the skin than plastic. And maybe it is the "tantrix" itself, the mandala the tiles create, that resonates with us and seems familiar, because it is a simulacrum of the tracery upon which life and consciousness depend.

The Book AND The Game?

Let's review:

- the name of the Chin tile suggests the association with Chinese culture;
- the hexagrams of the *Yi Jing* have six lines and Tantrix tiles have six sides;
- the *Yi Jing* has four kinds of lines and Tantrix tiles are painted in four colors;
- the *Yi Jing* has—let's see: 2^6, or 2x2x2x2x2x2… that's 64 hexagrams; and Tantrix...

Hey! There are only 56 tiles in the game of Tantrix! But here's where it gets interesting: there are actually 64 *possible* tiles, given six sides, four colors, and three different types of colored lines. The eight missing tiles are those that would contain *three straight lines*, and there would be two of these tiles in each suit.

Early versions of Tantrix (1991-1992) contained these tiles, known as "triple intersections" or T.I.s; but after playtesting, the inventor decided to remove them because they slowed the game. We can understand why that would be so. Each Rond, Brid, Chin, and Sint fits into six different three-sided spaces, and the T.I.s only fit three different three-sided spaces, making them much less versatile in game play. This study necessarily includes the T.I.s, as I assign each tile in the complete 64-tile set to one *Yi Jing* hexagram based on the following principles.

General Principles

To match the tiles with the hexagrams it was necessary to tease out of each the principles around which they were constructed. These principles are binary, sequential, and what I call familial. The tiles divide logically into five families (Ronds, Brids, Chins, Sints, and T.I.s) and four three-color suits; their binary and sequential aspects are hidden. The hexagrams are obviously binary; but their sequential characteristics (based on trigrams and changing lines) and their familial connections (the logical groupings into which they may be subdivided) are hidden. Yet all these aspects had to be considered in order to link the two.

I could have saved myself a lot of thought and effort had I been willing to match each tile with the hexagram of the same number, tacking the Triple Intersections onto the end; but lottery balls or chits of paper would do just as well for that. The tiles constitute a parallel binary system, and I believe they offer more than just their numbers.

My goal was to pair tiles with hexagrams in a way that would insure *reversibility*: knowing a few simple rules and without having to look up the numbers, we should be able to look at any tile and visualize the hexagram it represents, and we should be able to look at any hexagram and picture the matching tile. The specific "keys" I used to make tile-to-hexagram assignments will be found later in the "Tile Families" section; what follows here are the fundamentals.

Principle 1: *The Pie*. Assume everything, all reality, is a pie. Cut once, and you divide it into equal halves. Cut again and you have quartered the pie. Cut the diagonals, and there are now eight equal pieces. Each of the eight pieces is still part of one of the quarters; each of the quarters is still part of one of the halves. In just this way, *yin* and *yang*, the four images (*si xiang*: the four kinds of *Yi Jing* lines, the four Tantrix colors), and the eight trigrams (*ba gua*, see Principle 2) define "slices" of reality, and together, represent *all that is*. This is not really a principle, it's just good to know.

Principle 2: *Three Lines Form a Trigram*. There are eight possible arrangements of two things occupying three spaces. In the *Yi Jing*, the two are yin and yang, and the three places are the lines of a three-line image: a trigram. The eight trigrams symbolize a vast array of things (*everything*, in fact: see Principle 1), but are known generally by certain names: *Kun*—Earth; *Qian*—Sky; *Li*—Fire; *Kan*—Water; *Zhen*—Thunder; *Dui*—Cloud; *Sun*—Wind; *Gen*—Mountain. They can be arranged in different sequences, and in this study I use two: the Pre-Heaven (*xian tian*) Arrangement (see Fig. A) and what I call the VLS Linear Sequence (see Principle 8 and Fig. F). Also, when placed one above another, they form the bottom three lines and top three lines of the six-line hexagrams.

Principle 3: *Three "Powers"*. Six lines make a hexagram. There are complex relationships among these lines, but a crucial one here is the concept of "three powers" (*san cai*). In traditional Chinese cosmology the three powers are *Earth*, whose power is gravity; *Sky*, whose power has been coined by some wit as "levity;" and *Humanity* (which I prefer to extend to all living beings, so I refer to it in this study simply as the "middle" power. The power of the middle is "integrity:" holding the power of earth and the power of sky together in a dynamic tension. The three powers divide a hexagram into *pairs of lines* (see Principle

5): the bottom two lines represent Earth, the third and fourth line represent the Middle, and the top two lines represent Sky (Fig. D).

5ᵗʰ & top lines	= =	Sky
3ʳᵈ & 4ᵗʰ lines	= =	Middle
1ˢᵗ & 2ⁿᵈ lines	= =	Earth

Figure D: _The Three Powers as the Line Pairs of a Hexagram_.

Principle 4: _Four Energies_. When yin and yang interact, four things manifest. The original yin and yang, and also "yin becoming yang" and "yang becoming yin," This study symbolizes these energies in three ways:
- single lines: – – (yin); ⎯⎯ (yang); –o– (yang becoming yin); –x– (yin becoming yang). The _Yi Jing_ refers to these lines as numbers: 8, 7, 9, and 6 respectively.
- line pairs: = = (yin); ⎯⎯ (yang); ⎯ ⎯ (yang becoming yin); – – (yin becoming yang). See Principle 5.
- colors: Blue (yin); Red (yang); Green (yang becoming yin); Yellow (yin becoming yang). See Principle 10.

Principle 5: _Pairs_. The concept of three powers (Principle 3) makes three pairs out of the six lines of a hexagram. The four possible two-line combinations of yin and yang (Principle 4) each belong to one of two kinds of pairs:
- _Matched Pairs_: two adjacent lines of one type: two yin lines, or two yang lines. Because I refer to them so frequently, I call these "_m-pairs_."
- _Complementary Pairs_: two adjacent lines where one is yin and one is yang. Because I refer to them so frequently, I call these "_c-pairs_."

Principle 6: _Bottom Up_. Read trigrams and hexagrams from the bottom line to the top line. We have an unconscious tendency to read from the top down, yet the bottom line of a hexagram is called the "beginning," and is viewed as being earliest in time. The next line up is called the "second place," etc. In _Yi Jing_ divination, too, hexagrams are built from the bottom up.

Principle 7: _Clockwise_. Read the colored line ends clockwise around the circumference of Tantrix tiles; read the line ends in each open space around the edges of the game mosaic (the "tantrix") clockwise; and read the eight trigrams around the taiji diagram (Figs. A and E) clockwise.

Principle 8: _The Visible Light Spectrum_. No standard order of colors currently exists in Tantrix, as there has been no real need for one. The causal progression in the continually renewing cycle of energies in the _Yi Jing_, however, makes a parallel progression in the colors desirable. In the _Yi Jing_ (as in nature), yin is perpetually changing to yang and vice versa. For color, we find just such an unequivocal sequence in the _visible light spectrum_. The visible light spectrum (VLS for short) is the very narrow band of electromagnetic wavelengths to which our eyes are sensitive, and our sense of color is due to our brain's interpretation of these wavelengths.

The shortest wavelengths in the VLS (about 390-400 nanometers) appear violet or "blue" to us. Though blue is not at the end of the VLS, the blue-indigo-violet end of the spectrum is known as the "blue" end: in the Doppler Effect, for example, there is "red shift" and "blue shift," not "violet shift." The longest wavelengths in the VLS (around 700 nanometers) appear "red." In between are uncountable variations, but the custom is to refer to them as "ROY G BIV" (Red, Orange, Yellow, Green, Blue, Indigo, and Violet), a simplistic but catchy acronym. By linking the colors of Tantrix with the VLS, we are doing no more than acknowledging their authentic order in nature according to their actual properties: energy, frequency, and wavelength. Their sequence might be either Red→Yellow→Green→Blue, <u>or</u> Blue→Green→Yellow→Red. I discuss this in Principles 10 and 11, below.

Principle 9: *Blue is Yin, Red is Yang*. The symbolic language of Tantrix is color and shape. The symbolic language of the *Yi Jing* is somewhat more hierarchical and numerical. I am using the VLS to create a common language. For this, I needed a mutually acceptable referent so that the other points would line up. I decided to embrace the traditional Chinese association of red with yang. Accepting red as yang puts it at the *top* of the taiji diagram (Fig. E) representing Sky, and puts Blue at the bottom representing Earth. On the surface,
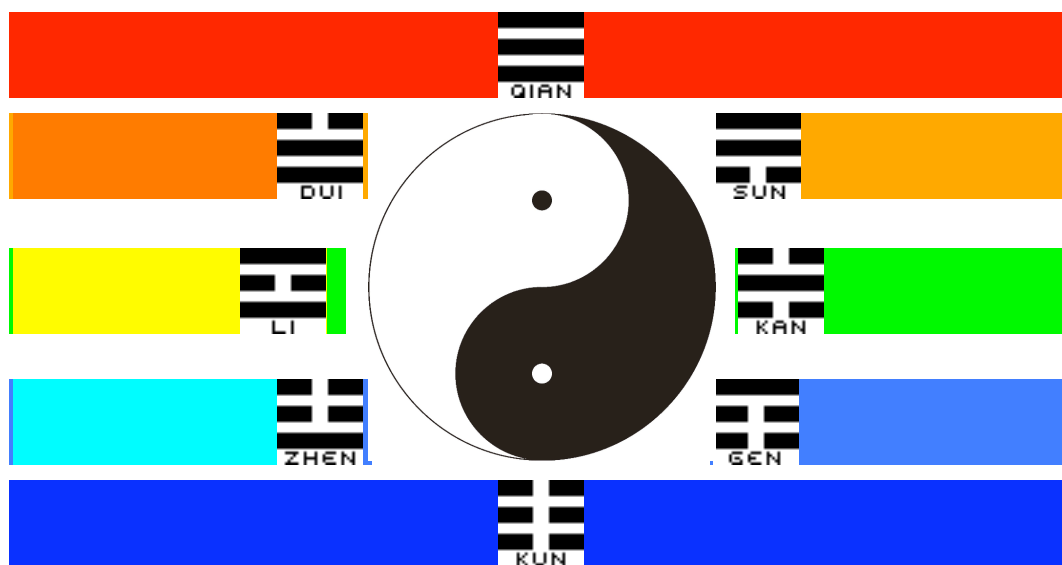
Figure E: *Pre-Heaven (xian tian) Arrangement as a Spectrum*.
Colors on right and left dovetail like interlacing the fingers, with *Sun* between *Dui* and *Li*,
***Kan* between *Li* and *Zhen*, and *Gen* between *Zhen* and *Kun* (see Figure F).**

this may seem paradoxical in that we think of "sky" as blue and earth as the colors of soils or clays in the yellow/red range. The power of sky/heaven, however, does not come from its background of blue, but from the light and heat we received from the sun. In this context, Red is far more appropriate. We also now know that our world appears blue from space, in that about 70% of earth's surface is covered with water. Other traditional Chinese associations reinforce this too, such as hot, dry, day, fire, sun, etc. for red/yang and cool, moist, night, water, moon, etc. for blue/yin. Placing red at the top of the taiji diagram doesn't imply that it is a more "spiritual" color. All colors have spiritual import. In eastern

energetics, the blue end of the spectrum is associated with the higher chakras (energy centers) in the body. Red generally signifies passion, warmth, vibrancy, determination, vigor, etc. It is interesting to note, however, that the Chinese place "south" at the top of the taiji diagram, not the bottom. Knowing this might help resolve the red-over-blue issue for the western mind.

Color therapy also reinforces the identification of yin with blue and yang with red. In *Discover Color Therapy*, author Helen Graham says: "Most living things appear to be vitalized by the bright reds, oranges, and yellows of daylight -- and calmed and rejuvenated by the blues, indigos, and violets of the night." Information on color therapy or chromatherapy is widely available, though outside the scope of this study. Players of Tantrix may wish to pursue this to learn more about the physical and psycho-spiritual implications and benefits of playing regularly with all four colors.

BGR	GYR		BGY	BYR	eV
		RED			1.8
7.4	6.6	YELLOW		7	2.2
		GREEN	7.8		2.6
		BLUE			3.0

**Table 1. *Approximate Electron-Voltage (eV) for Individual Colors (Right Column)
and for Tantrix Suits (Sum of 3 Colors)*.
*As the energy of light increases, the wavelength decreases.***

Nevertheless, there is still a paradox in our association of blue with cooler, calmer, thoughtful states and feelings. Electromagnetic radiation at the blue end has shorter wavelengths and higher electron-voltage (energy) than light/radiation at the red end (see Table 1). While red-end phenomena such as infrared and microwave have a warming effect, blue end phenomena (ultraviolet, x-rays, gamma rays) cause ionization and have a destructive effect. Blue stars are hotter than red stars, and blue flame is hotter than yellow or red flame. So let us not underestimate the blue power of yin, but to avoid argument, remember also that sunlight is a source of *both* red and blue end radiation.

Principle 10: *First Yin, then Yang*. There is no correct direction along the visible light spectrum: it is equally legitimate to read from blue to red and from red to blue. But for this study, it was necessary to establish a standard sequence so that the association of tiles with hexagrams would be consistent and reproducible, rather than arbitrary. So given the need for a choice, do we start with red or blue?

To answer this, I returned to the taiji diagram. In the Pre-Heaven Arrangement (Figs. A & E), each trigram creates the next in an unending clockwise circle. Where might it be said to begin? In Chinese cosmology, all things arise from nothing, *wuji*. Yet before nothing is

Dao, which no one can adequately define, for it is by definition indefinable. Stephen Mitchell refers to it, in his translation of the *Daodejing*, as "the way things are." The Great Treatise says "That which lets now the dark, now the light appear is tao [Dao]" (*Wilhelm YJ* p. 297).

So yin and yang both arise within nothingness because of Dao. Yin represents stillness, darkness, potential, and emptiness in the sense of waiting. Yang represents action and motion. Which came first? True, it's "chicken and egg," but in our world, stillness precedes motion, waiting precedes action—like sprinters before the starting gun is fired. In the Great Treatise we find: "Heaven and Earth determine the direction… Thunder brings about movement… Keeping Still brings about standstill" (*Wilhelm YJ* p. 265-7). Between Keeping Still (the mountain trigram *Gen*) and Thunder (the trigram *Zhen*, also known as "The Arousing*")* is *Kun*, the earth trigram: full yin… *and the blue end of the VLS.* Wilhelm, in his comments regarding the cyclic nature of the trigrams, says:

> "There are two directions of movement, the one rightward [clockwise] ascending, the other backward, descending. The former starts from the low point, K'un [Kun], the Receptive, earth; the latter starts from the high point, Ch'ien [Qian], the Creative, heaven" (*Wilhelm YJ* p. 284).

All this points to blue (*Kun*, earth) as the starting point in the cycle of the trigrams, and gives us the sequence Blue→Green→Yellow→Red; and then, as Wilhelm points out, once we arrive at the top of the diagram, the return to blue is also posited. I could simply have said that because Principle 6 tells us "bottom up," we start all sequences from the blue end (the bottom of the taiji diagram) despite ROYGBIV. But perhaps a little explanation has helped justify this choice.

Principle 11: ***Yellow is Fire, Green is Water***. The visible light spectrum progresses from blue at the bottom of the taiji diagram to red at the top (Fig. E). The spectrum exists equally on the left and right sides of the diagram: on the left it ascends from blue to red, and on the right it descends from red to blue. The three pairs of trigrams on opposite sides are in exactly the same positions along the spectrum, except that on the left their *tendency* is upward, and on the right it is downward. Fire (*Li*) and Water (*Kan*), for example, are both at the halfway point in the middle of the green/yellow section of the spectrum: Fire is half-yang-half-yin, and Water is half-yin-half-yang; as in the old optimist/pessimist joke, Fire says the glass is half full, Water says it is half empty. So which is *more* green, which is *more* yellow?

Fire is still yin (the "middle daughter" in the family of trigrams), but it is *becoming yang*. So I place it just *above* the center on the left side, closer to the top, and therefore assign it the color yellow. Water is still yang (the "middle son" in the family of trigrams), but it is *becoming yin*. So I place it just *below* the center on the right side, closer to the bottom, closer to blue, and therefore I assign it the color green.

I follow the same logic with the other trigrams, lowering those on the right and raising those on the left to create the Linear Trigram Sequence (Fig. F), which results when the two sides dovetail together like interlacing the fingers of both hands. The sequence zig-zags across the circle (Kun to Gen, Gen to Zhen, Zhen to Kan, etc.). It will be important to keep in mind that

Fire (yellow) is considered *yin*, and Water (green) is considered *yang* (see Principle 12) even though they are both actually half and half.
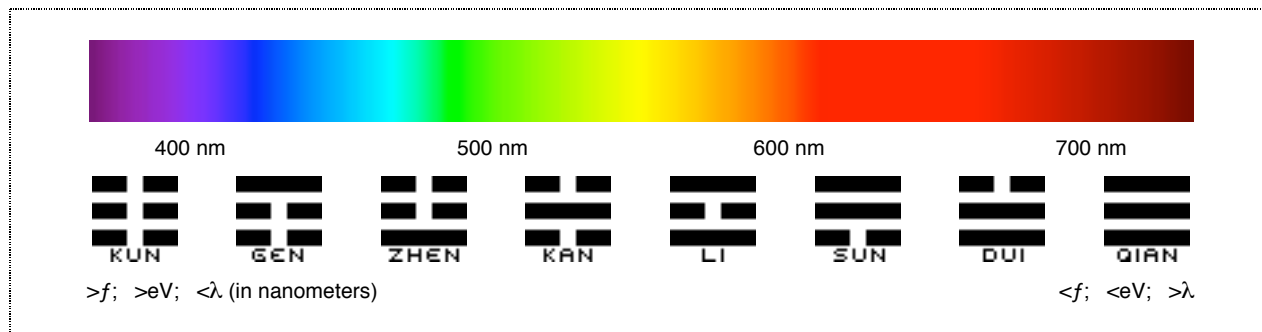

Figure F: *Linear Trigram Sequence Associated with Visible Light Spectrum*.

Principle 12: *Red and Green, Blue and Yellow*. Often it is necessary to indicate the relative placement of a line (as in the Chin family) or a pair (as in the Sint and Brid families). The two yang colors, red and green, and the two yin colors, blue and yellow, then serve as markers. Red indicates the upper position, primarily of a yang line or yang pair, and blue indicates the lower position, primarily of a yin line or yin pair. Green, as the subordinate yang color, usually indicates the lower position of a yang line or pair, and yellow, the subordinate yin color, usually indicates the upper position of a yin line or pair.

The task of figuring out which Tantrix tile matches which hexagram required the application of the preceding principles, and additional groupings and sequences of tiles and hexagrams that I explain as I discuss each tile family. I begin with the Chin, and proceed to the Brids, Ronds, Sints, and finally, to the Triple Intersections (T.I.'s). Table 2 is a summary and a prelude:

Tile Families	Hexagrams
T.I.s (8)	the 8 primary hexagrams (bottom and top trigrams are the same)
Ronds (8)	6 hexagrams with three m-pairs *(#1 & #2 fit this description, but belong to the T.I.s)* the final two hexagrams: #63 & #64
Brids (12)	the 12 hexagrams with 3 yin & 3 yang, one c-pair and two m-pairs
Chins (12)	the 12 hexagrams with either five yin or five yang lines

Sints (24)	18 hexagrams with one m-pair and two c-pairs
	     (six primary hexagrams fit this description, but belong to the T.I.s)
	6 hexagrams with three c-pairs
	     (#63 & #64 fit this description, but belong to the Ronds)

Table 2: *Index of Tiles and Hexagrams by Tile Families*.

Tile Families

The Chins (12 Tiles)

The twelve Chins (see Fig. C) correspond to the twelve hexagrams that have either five yin or five yang lines. The key to figuring out which hexagram a Chin tile represents is to note the color of the straight and the colors of the bends. The color of the straight indicates whether the solitary line is yin or yang, and whether it is in the upper or lower trigram. If the straight is Blue, the line is *yin* and will be one of the *bottom* three lines; if Yellow, the line is *yin* and will be one of the *top* three lines. If the straight is Green, the line is *yang* and will be one of the *bottom* three lines; if Red, the line is *yang* and will be one of the *top* three lines. But which one?

Each Chin with a straight of a given color has three possible combinations of bends. The average position on the VLS of these bend combinations reveals whether the odd line is the bottom, middle, or top line of a trigram. Suppose the straight is Red, and the bends are Blue and Yellow (Tile #9, Fig. C). An acceptable value for the wavelength (λ) of visible blue/violet light is 400nm (nanometers); green may be said to be around 500nm, yellow around 600nm, and red around 700nm. The average of Blue and Green (B::G) is 450, Blue::Yellow = 500, and Green::Yellow = 550. The Red straight tells us the odd line is yang, and in the top trigram; Blue and Yellow bends tell us that the single yang line is the *middle* line of the top trigram: the hexagram is *Yi Jing* #8, Union.

Suppose the straight is Blue and the bends are Yellow and Red (Tile #4). The average wavelength value of the two bends, Y::R, is 650. The other two possibilities are G::R=600 and G::Y=550. So the Yellow and Red bends tell us the single yin line represented by the Blue straight is at the *top* of the lower trigram: the hexagram is *Yi Jing* #10, Treading.

Hexagram #	Hexagram name	Tantrix tile #
7	The Army	39
8	Union	9
9	Taming Power of the Small	44
10	Treading	4
13	Fellowship	40
14	Possession in Great Measure	6
15	Modesty	32
16	Enthusiasm	42
23	Splitting Apart	34
24	Return	51
43	Breakthrough	35
44	Coming to Meet	50

Table 3: *Key to the Twelve Hexagrams Represented by Chin Tiles*.

The Brids (12 Tiles)

Twenty-four hexagrams contain exactly two matched pairs of lines in earth, middle, or sky positions. Twelve of these have five lines of one type (yin or yang), and therefore belong to the Chin family of tiles. The twelve remaining hexagrams are composed of three yin lines and three yang lines, and contain one complementary pair, or "c-pair" (a yin and a yang together: see Principle 5), and two matched pairs, or "m-pairs" (two yin or two yang). In each of these hexagrams, the m-pairs are different: one pair of yin lines and one pair of yang lines. The Brid tile pattern is two corners of different colors with a straight between them; their symmetry suggests that they very appropriately stand for these twelve hexagrams.

The Brid tiles need to convey three bits of information for us to be able to move from tile to hexagram and from hexagram to tile:

1) whether the c-pair is _ _ "yin becoming yang" or _ _ "yang becoming yin,"
2) whether the c-pair is in the earth, middle, or sky position, and
3) which m-pair, the yin lines or the yang lines, is above and which m-pair is below relative to each other.

• The color of the straight gives us the first bit of information: if the straight is Blue or Yellow, the c-pair is _ _ , "yin becoming yang;" if the straight is Green or Red, the c-pair is _ _ , "yang becoming yin."

Figure G: *Brid Tile and Hexagram*.

• The average λ value of the two corners gives us the second bit of information. For each straight color, there are three possible pairs of corners. As with the Chins, we find the average position of the two colors on the VLS (Blueλ=400, Greenλ=500, Yellowλ=600, and Redλ=700 nanometers; see the top two rows of Table 8) and compare it to the averages of the two other possibilities. The average of the two corner colors tells us in this case whether the c-pair is located in the earth, middle, or sky position (Principle 3) of the hexagram. If the average λ of the corners is the shortest of the three possibilities, the c-pair will be in the earth position; if the average λ is the middle of the three possibilities, the c-pair will occupy the middle position; if the average λ is longest, the c-pair will be in the sky position.

• For the third bit of information, we return to the straight. Two of the straights represent yin, two represent yang. The color of the straight indicates whether the m-pair *of the same type as*

the straight is above or below the other m-pair. If the straight is Blue, the yin m-pair will be *below* the yang m-pair; if the straight is Yellow, the yin m-pair will be *above* the yang m-pair; if the straight is Green, the yang m-pair will be *below* the yin m-pair; if the straight is Red, the yang m-pair will be *above* the other m-pair.

Let's say we're looking at a Brid that has a Green straight and Blue and Yellow corners (Tile #49, Fig. G). The Green straight means first that the c-pair is ⚊ ⚊ "yang becoming yin," and Blue/Yellow corners (average 500nm) mean the c-pair is in the *bottom* position, the other possibilities being Blue/Red (550nm), which would indicate the middle position, and Yellow/Red (650nm), which would indicate the sky position. That the straight is Green also means the yang m-pair is *below* the yin m-pair. So the hexagram is *Yi Jing* #32, Duration.

C-pair at top (sky):

Hexagram #	Hexagram name	Tantrix tile #
31	Influence	2
41	Decrease	22
56	The Wanderer	15
60	Limitation	16

C-pair in middle:

Hexagram #	Hexagram name	Tantrix tile #
11	Peace	13
12	Standstill	5
53	Gradual Progress	24
54	The Marrying Maiden	26

C-pair at bottom (earth):

Hexagram #	Hexagram name	Tantrix tile #
32	Duration	49
42	Increase	48
55	Abundance	47
59	Dispersion	30

Table 4: *Key to the Twelve Hexagrams Represented by Brid Tiles*.

The Ronds (8 *Tiles*)

The Rond pattern of three corners with an "AA-BB-CC" clockwise line-end format are an obvious match for hexagrams with matched pairs in earth, middle, and sky positions. Eight hexagrams exhibit this pattern. Two of these, #1 "The Creative" (all yang lines) and #2 "The Receptive" (all yin lines) are primary hexagrams, or "doubled signs," formed by doubling one of the eight trigrams. The doubled signs are represented by the eight Triple Intersection tiles (see below). This leaves only six hexagrams, so we need two more hexagrams to round out the complement of Ronds.

Fortunately, two hexagrams stand out in this regard: #63 "After Completion," and the last hexagram, #64, significantly named "*Before* Completion." Although their line pattern is that of the hexagrams represented by Sint tiles, these two are the final hexagrams in the *Yi Jing* and serve a somewhat separate and special purpose. They bring us back around, looping the line of

energy, signifying that what might have seemed linear is actually circular: reminding us that as things finish they also begin anew. As such, they appropriately join the family of Ronds.

Rond tiles come in four pairs: one pair per suit. On one of these, reading clockwise, the corners will be in the correct order according to the VLS. The eight hexagrams in this group also divide neatly into four pairs. The final two hexagrams in the *Yi Jing* make one pair. The other six hexagrams have one pair of yin lines and two pair of yang lines, or vice versa. Two have the single m-pair in earth position, two have the single m-pair in the middle, and two have the single m-pair in the sky position. All we need to do is match the hexagram pairs to the Rond suit pairs.
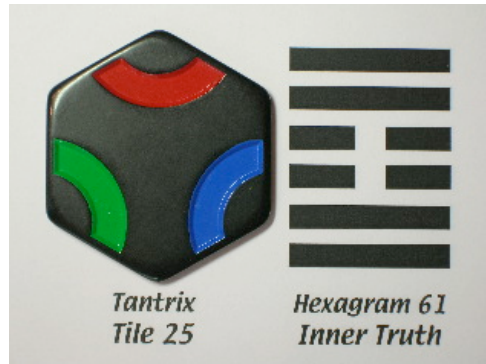

Figure H: *Rond Tile and Hexagram*.

Rond tiles carry two bits of information: their suit, and whether the corners are in or out of VLS order starting from the Blue end ($B\rightarrow G\rightarrow Y\rightarrow R$). Fortunately, using Principles 3 and 10, we can place the hexagrams in a logical order based also on only two bits of information: the power position of the single m-pair, and whether that single m-pair is yin or yang.

There are four "suits" of 14 tiles in Tantrix: B-G-Y (No Red), B-G-R (No Yellow), B-Y-R (No Green), and G-Y-R (No Blue). Once again, using wavelength values from the VLS (Blueλ = 400 nm, Greenλ = 500 nm, Yellowλ = 600 nm, and Redλ = 700 nm) we can find the average wavelengths for the suits:

Suit	B – G – Y	B – G – R	B – Y – R	G – Y – R
Individual Color λ	400-500-600	400-500-700	400-600-700	500-600-700
Suit Average λ	**500 nm**	**533 nm**	**566 nm**	**600 nm**

Table 5: *Wavelength (λ) Averages for the Four Tantrix Suits*.

Starting with the suit closest to the Blue end of the VLS and following Principles 6 and 10:
- I assign the two B-G-Y tiles, from the suit with the shortest average λ, to the two hexagrams with the single m-pair in the *earth* position, matching the hexagram with the *yin* m-pair to the tile with corners in VLS order (BB-GG-YY reading clockwise).

- I assign the two B-G-R tiles to the hexagrams with the single m-pair in the *middle* position, matching the hexagram with the *yin* m-pair to the tile with corners in VLS order.
- I assign the two B-Y-R tiles to the hexagrams with the single m-pair in the *sky or top* position, matching the hexagram with the *yin* m-pair to the tile with corners in VLS order.

The final two Ronds in the G-Y-R suit I assign to Hexagrams #63 and #64; and assign the tile in VLS order to Hexagram #63, because as the *Yi Jing* says, in that hexagram all lines are in their "proper places" (a yang line in the first place, a yin in the second, etc.).

Single m-pair at top (sky):

Hexagram #	Hexagram name	Tantrix tile #
34	Power of the Great	3
20	Contemplation	14

Single m-pair in middle:

Hexagram #	Hexagram name	Tantrix tile #
61	Inner Truth	25
62	Preponderance of the Small	28

Single m-pair at bottom (earth):

Hexagram #	Hexagram name	Tantrix tile #
33	Retreat	45
19	Approach	43

Three C-pairs:

Hexagram #	Hexagram name	Tantrix tile #
63	After Completion	23
64	Before Completion	21

Table 6: *Key to the Eight Hexagrams Represented by Rond Tiles*.

The Sints (24 *Tiles*)

The Sint pattern (see Fig. B) is one matched pair (a corner) and two complementary pairs (crossed bends): AA-BCBC if read clockwise starting with the corner. The c-pair is the defining characteristic of the Sint tile, as the m-pair is of the Ronds and Brids. Twenty-four hexagrams are composed of one m-pair and two c-pairs, and match the Sint pattern perfectly. Six of those, however, are primary hexagrams, and are more appropriately represented by the T.I. tiles.

Eight hexagrams contain three c-pairs; two of these, hexagrams #63 and #64, have been separately assigned to the Ronds. This leaves us with eighteen hexagrams containing two c-pairs and six hexagrams containing three c-pairs, for a total of twenty-four hexagrams… and as it happens, there are twenty-four Sint tiles!

Not only are there twenty-four tiles and twenty-four hexagrams remaining, but both tiles and hexagrams divide easily into four groups of six. Six of the twenty-four tiles have a Blue corner, six have a Green corner, six have a Yellow corner and six have a Red corner. Six of the hexagrams have an m-pair at the bottom, six have an m-pair in the middle, six have an m-pair at

the top, and six are composed of three c-pairs. So we need only assign the four groups of tiles to the four groups of hexagrams.

I assigned the tiles with Blue, Yellow, and Red corners to the hexagrams with the m-pair in earth, middle, and sky positions respectively, because in this study Blue and Red stand for bottom and top, and in Chinese culture, yellow is often associated with the concept of the "middle." So by default, I assigned the six tiles with a Green corner to the group of six hexagrams that contain three c-pairs. To match tiles to hexagrams, I then rank ordered tiles and hexagrams within the four groups based on relative wavelengths.

The Four Kinds of Line Pairs	= = yin	⎯⎯ yang becoming yin	= = yin becoming yang	⎯⎯ yang
Color in VLS Sequence	**Blue**	**Green**	**Yellow**	**Red**
Wavelength λ	400nm	500nm	600nm	700nm
Rank Order	**1**	**2**	**3**	**4**

Table 7: _Rank Ordering of M-pairs, C-pairs, and Colors_
Starting from the Blue End of the VLS.

To rank order the six hexagrams within each group of hexagrams containing a single m-pair, I assigned an *ordinal number* to each line pair within each hexagram based on the color associated with that pair (see Table 7). I then added the three ordinal numbers for each hexagram and compared hexagram totals within groups.

Line Pairs	Ordinal Number
= =	2
⎯⎯	2
= =	1
Total:	5

Figure I: _Line Pairs and Ranks for Hexagram #35 Based on Table 7_.

For hexagram #35 Progress for example, the values for the pairs of lines in three-power positions are 1 for the yin pair in earth position and 2 each for the "yang becoming yin" pairs in the middle and sky positions, for a total of 5 (Fig. I). This is the lowest value of any hexagram in the group with an m-pair in the <u>bottom</u> position (see Table 10), so #35 is the first hexagram in that group.

How do we discover which of the six Sint tiles with a Blue corner is first, and therefore represents hexagram #35? We look at the *bends* of all the tiles in question. Like shoelaces, when lines cross one another on a tile, one color (or two in the case of T.I. tiles) is underneath the other. This feature provides another bit of information, allowing us to arrange the Sints in a

sequence based first on the average wavelength of the two bends, and then on the wavelength of the top or prominent color.

For example, there are two Sint tiles with a Blue corner and Green and Yellow bends. On one tile the Green bend is prominent (G/Y), and on the other the Yellow bend is prominent (Y/G). Based on wavelength value starting from the Blue end of the VLS, the G/Y tile ranks before the Y/G tile. So the six Sint tiles with a Blue corner can be put into this sequence: G/Y, Y/G, G/R, R/G, Y/R, R/Y, by their ordinal rankings (5th, 6th, 7th, 8th, 9th, and 10th). This information is presented in Table 8 for all the Sint tiles. Tile #56 has the highest rank (corresponding to the lowest average bend λ value) among these six tiles, so it represents hexagram #35.

"Sint" Bend Pairs	Blue & Green		Blue & Yellow		Green & Yellow		Blue & Red		Green & Red		Yellow & Red	
Average λ	450		500		550		550		600		650	
Bend on Top/Bottom	/	\	/	\	/	\	/	\	/	\	/	\
	B/G	G/B	B/Y	Y/B	G/Y	Y/G	B/R	R/B	G/R	R/G	Y/R	R/Y
Tile Rank	1st	2nd	3rd	4th	5th	6th	5th	6th	7th	8th	9th	10th

Table 8: _Rank of Sint Tiles Based First Upon Bend Color Averages and Then Upon Which Bend is on Top of the Other (B/G = "Blue over Green")_.

While the six Green-cornered Sint tiles can be ranked by the same method as the other Sints, the six hexagrams they symbolize present a special challenge. When we calculate the rank order values for the three c-pairs in these hexagrams, we do not find the same convenient spread of ordinal rankings. Instead, we get three tiles ranked 7th and three tiles ranked 8th: not enough differentiation to allow us to place them in a sequence. This is because all six of these hexagrams are composed of only two types of line pairs, represented by Green and Yellow in Table 7, above.

Hex #	22	48	17	18	21	47
Derived trigram	GEN	ZHEN	KAN	LI	SUN	DUI
Trigram's VLS rank (among all 8 trigrams)	2	3	4	5	6	7

Table 9: _Trigrams Derived from the Six "Sint" Hexagrams with Three C-Pairs_.

So we must rank the group of hexagrams with three c-pairs in another way. I converted each pair of lines to their basic yin or yang value, remembering that "yang becoming yin," although it is a changing line, is first regarded as *yang*; and "yin becoming yang," although it too is a changing line, is first regarded as *yin*. In this way, the three pairs of lines in each of these hexagrams are reduced to a trigram. I then ranked the trigrams according to the linear spectrum of the trigrams shown in Figure F. Table 9 displays the results for these six hexagrams (1 *Kun* and 8 *Qian* do not appear), with consequent Green-corner Sint matches shown in Table 13.

Hexagram	Hexagram name	Rank Order of Line Pairs	Tile Rank Acc. to Bends (See Table 8)	Tile
35	Progress	1+2+2=5	5	56
45	Gathering Together	1+2+3=6	6	55
39	Obstruction	1+3+3=7	7	38
38	Opposition	4+2+2=8	8	37
26	Taming Power of the Great	4+3+2=9	9	8
5	Waiting	4+3+3=10	10	7

Table 10: *Hexagrams with M-pair at the* **Bottom** *Matched to SINT Tiles with a* **Blue** *Corner*.

Hexagram	Hexagram name	Rank Order of Line Pairs	Tile Rank Acc. to Bends (See Table 8)	Tile
4	Youthful Folly	2+1+2=5	1	53
27	Providing Nourishment	3+1+2=6	2	54
3	Difficulty at the Beginning	3+1+3=7	5	10
50	The Caldron	2+4+2=8	6	1
28	Preponderance of the Great	2+4+3=9	7	18
49	Revolution	3+4+3=10	8	17

Table 11: *Hexagrams with M-pair in the* **Middle** *Matched to SINT Tiles with a* **Yellow** *Corner*.

Hexagram	Hexagram name	Rank Order of Line Pairs	Tile Rank Acc. to Bends (See Table 8)	Tile
40	Deliverance	2+2+1=5	1	29
46	Pushing Upward	2+3+1=6	2	27
36	Darkening of the Light	3+3+1=7	3	12
6	Conflict	2+2+4=8	4	11
25	Innocence	3+2+4=9	5	20
37	The Family	3+3+4=10	6	19

Table 12: *Hexagrams with M-pair at the* **Top** *Matched to SINT Tiles with a* **Red** *Corner*.

Hexagram	Hexagram name	Rank Order of Line Pairs	Tile Rank Acc. to Bends (See Table 8)	Tile
22	Grace	2	3	52
48	The Well	3	4	46
17	Following	4	5	36
18	Work on What Has Been Spoiled	5	6	41
21	Biting Through	6	9	31
47	Exhaustion	7	10	33

Table 13: *Hexagrams with Three C-pairs Matched to SINT Tiles with a* **Green** *Corner*.

The T.I.s *(8 tiles, not included in the current Tantrix set)*

The eight trigrams, the *ba gua*, depict all possible three-line combinations of yin and yang. Eight "primary" hexagrams are produced when these trigrams are doubled: that is, when the same trigram occurs as both the top three and bottom three lines of a hexagram. In a primary hexagram, the first line has the same yin or yang value as the fourth, the second is the same as the fifth, and the third line is the same as the top. The line-ends of the eight T.I. (Triple Intersection) tiles also exhibit this symmetry.

Initially, it would seem that any T.I. tile might stand for any primary hexagram. However, relying once again on the visible light spectrum from Blue (yin) to Red (yang), and on the *xian tian* arrangement of the trigrams (Fig. A), a coherent and beautiful pattern emerges.
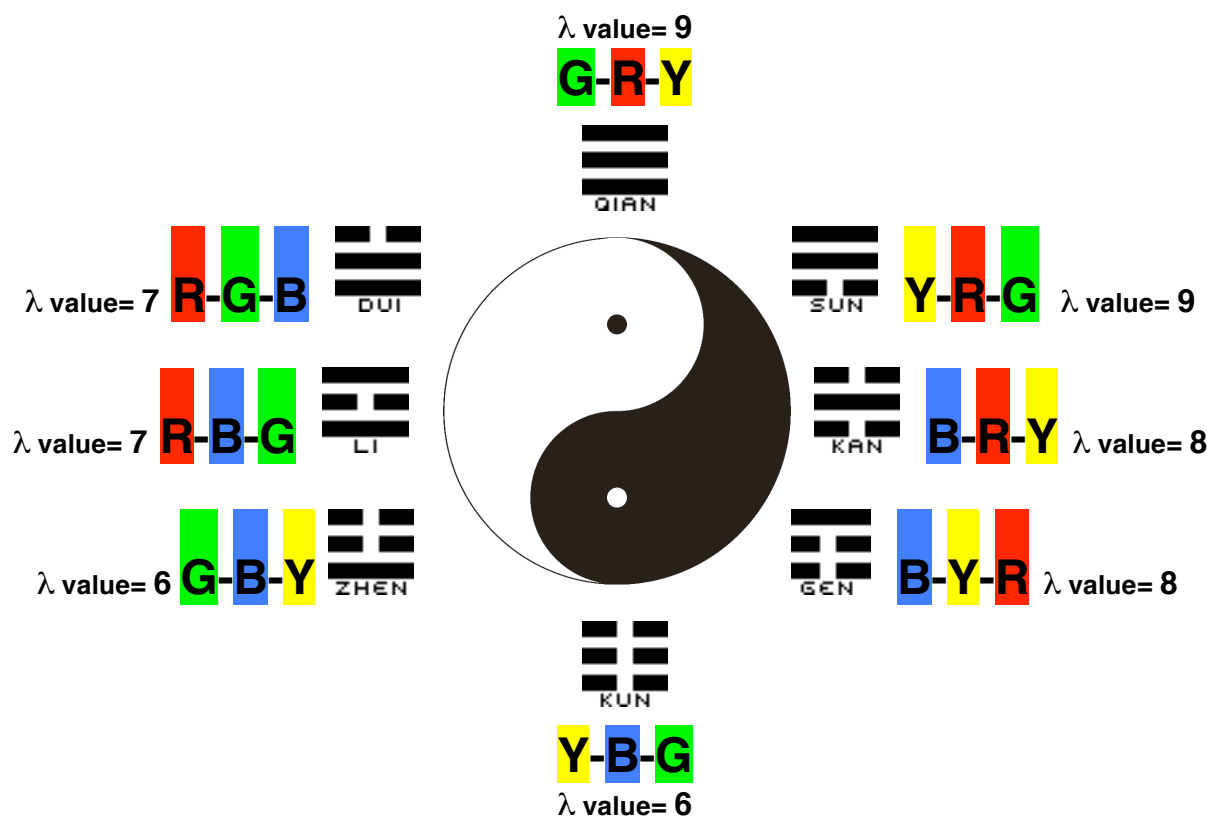

Figure J. *Tantrix T.I. (Triple Intersection) Tiles Matched to the Eight Trigrams*.
The colors sequences shown match the lines of the trigrams from bottom up.
When doubled, the trigrams form the eight primary hexagrams (Table 15).
λ values are sum of ordinal numbers for the three colors (Table 7).

The motion implicit in the *xian tian* arrangement is revealed in the diagram of yin and yang that it surrounds. On the left side, yang bursts upward like a new shoot from within the Earth trigram, *Kun*, at the bottom (see Principle 10). The transformation of the lowest line in *Kun* from yin (Yellow) to yang (Green) creates the trigram Thunder, *Zhen*. This initiates the clockwise motion which continues as yang pushes strongly upward like a shoot breaking through the soil, until at the top, the Blue yin line in Cloud, *Dui* (also called "Lake") gives way to yang, producing Sky (*Qian*): full yang. The cycle then continues down the right side as the Green yang

line in Sky changes to the Yellow yin line in Wind, Blue enters at the bottom of Water whose top line becomes Yellow yin by the change of Wind's Green yang line, and Red yang rises to the top of Mountain before being pushed out by the upwelling of Blue yin, and we return to Earth.

I assigned colors to the trigrams based on their yin or yang line values, the morphing of line energies from each trigram to the next in clockwise order, and the three-color combinations that would place 6, 7, 8, and 9 wavelength, λ, values (see below) in appropriate locations around the taiji diagram. Blue always stands for a yin, or broken, line; Red always stands for a yang, or solid, line. Green and Yellow are somewhat ambiguous. Green, the lesser yang color, can represent 1) firm yang in *Zhen* and *Dui*; 2) old yang about to be yin in *Li*, *Qian*, and *Sun*; or 3) young yin in *Kun*. Yellow, the lesser yin color, can represent 1) firm yin in *Sun* and *Gen*; 2) old yin about to be yang in *Kun*, *Zhen* and *Kan*; or 3) young yang in *Qian*.

Figure K: *Triple Intersection (T.I.) Tile and Hexagram*.

With colors assigned to the trigrams, the patterns of the eight T.I. tiles then became apparent, and I chose to begin numbering them at the Blue end of the spectrum (Principle 10), so that Hexagram 2 is represented by Tile 57, and the remaining seven follow in the VLS linear sequence (Principle 11).

Any combination of G, Y, and R (2 + 3 + 4)	**= 9 =**	*Qian* and *Sun*
Any combination of B, Y, and R (1 + 3 + 4)	**= 8 =**	*Kan* and *Gen*
Any combination of B, G, and R (1 + 2 + 4)	**= 7 =**	*Li* and *Dui*
Any combination of B, G, and Y (1 + 2 + 3)	**= 6 =**	*Kun* and *Zhen*

Table 14: *Wavelength (λ) Values for Suits and T.I. Pairs, Based on Table 7*.

We might linger a little over the elegant pattern that has resulted here. Adding the ordinal λ values for the colors (Table 7) in each trigram, we arrive at the λ values shown in Fig. J, and in Table 14, above. Coincidentally, the *Yi Jing* uses the numbers "6" through "9" to represent the four line types shown as line pairs at the top of Table 7: numbers derived from the piles of four stalks remaining at the end of the three operations needed to obtain a line in the yarrow stalk method, or from adding up "2s" for yin and "3s" for yang in the coin method. We have obtained the same values by assigning ordinal numbers to four colors on the VLS, and now they array themselves where we might have expected on the taiji diagram. Earth (*Kun*) and Thunder (*Zhen*)

have the λ value of 6. In the *Yi Jing*, a "6" is a changing line that begins as yin and then becomes yang. Earth is yin, but it is so full (mature) that yang appears within it (pictured as the eye of yang within yin in the taiji diagram), transforming it into Thunder. Sky (*Qian*) and Wind (*Sun*) have the λ value of 9. In the *Yi Jing*, a "9" is a changing line that begins as yang and then becomes yin. Sky is yang, but so full that yin appears within it, transforming it into Wind.

Fire (*Li*) and Cloud (*Dui*) have the λ value 7, which in the *Yi Jing* represents unchanging yang. Water (*Kan*) and Mountain (*Gen*) have the λ value 8, which in the *Yi Jing* represents unchanging yin. Appropriately, these four trigrams are situated on either side of the taiji diagram in the middle of the curves of their respective energies, where yin and yang are stable: neither new nor old.

Note that Red, yang, rises from the bottom line of *Li* and *Dui* to the middle of *Qian*, *Sun*, and *Kan*, and finally to the top of *Gen*. Blue follows a similar progression from the bottom of *Kan* to the top of *Dui* before vanishing as yang becomes full.

Hexagram #	Hexagram name	T.I. colors (clockwise)
2	The Receptive (Earth)	[#57] **YBG-YBG**
52	Keeping Still (Mountain)	[#58] **BYR-BYR**
51	The Arousing (Thunder)	[#59] **GBY-GBY**
29	The Perilous (Water)	[#60] **BRY-BRY**
30	The Clinging (Fire)	[#61] **RBG-RBG**
57	The Gentle (Wind)	[#62] **YRG-YRG**
58	The Joyous (Cloud)	[#63] **RGB-RGB**
1	The Creative (Sky)	[#64] **GRY-GRY**

Table 15: *The Eight Primary Hexagrams Matched with T.I. Tiles*
Ascending order of hexagrams from 57 to 64 follows the VLS Linear Sequence
of their component trigrams (see Principle 11).

THE GREAT FIELD OF ACTION

What do we gain from this correlation of game and book? From the hexagrams, the tiles gain names, individual identity, and archetypal meaning drawn from a deep well of wisdom. The tiles, however, can only be emblems, while the hexagrams are symbols. The *Yi Jing* is a coherent symbolic system, both precise and nuanced. The significance of lines, line pairs, trigrams, and their relationships, consideration of place and time, of image and judgment have been established for millennia; yet there are so many layers that interpretation, by design, is more intuitive than exact. As it claims to be, the *Yi Jing* is a reflection of reality and a key to its complexity. Lacking the *Yi Jing's* history and cultural context, the tiles can only represent what

the hexagrams embody. Yet with the brashness of youth, Tantrix offers two unique gifts: color and another dimension of hexagonal connection.

The four-colored Tantrix tiles bring a bit of Oz to the black and white ogham of the *Yi Jing*. This is not superfluous: it is a new perspective. For example, we might begin to regard hexagrams with more than three yin lines as "blue shifted," hexagrams with more than three yang lines as "red shifted." The lines are waves revealing inherent movement toward and away: a Doppler effect in matter, energy, and time. Yin is approaching, yang is moving away, changing lines are passing or reversing; or the observer might be moving in relation to the source. Wilhelm comments: "The movement from within outward shows tao [Dao] in its manifestations… the movement from without inward conceals the results of its workings" (*Wilhelm YJ* p. 299).

The *Yi Jing* refers to this as "the great field of action:" "It [Dao] possesses everything in complete abundance: this is the great field of action. It renews everything daily: this is its glorious power" (*Wilhelm YJ* p. 299). In the Great Treatise we find "When we continue and go further and add to the situations [hexagrams] all their transitions, all possible situations on earth are encompassed." Wilhelm explains: "Each of the sixty-four hexagrams can change to another through the appropriate movement of one or more lines. Thus we arrive at a total (64x64) of 4,096 transitional stages, and these represent every possible situation" (*Wilhelm YJ* p. 313).

A hexagram is like a cosmic UPC code: its information is encoded in its lines, and each hexagram represents the entirety of a situation. To look ahead, or to look back, we change the character of one or more lines in single hexagram, animating it as if it were the subject of a flipbook; for the *Yi Jing* shows us essentially *one* six-line structure, which changes by the metamorphosis of its component lines.

Tantrix tiles, on the other hand, are designed by geometry and combinatorial valence to create patterns and relationships. The hexagonal tiles are engineered for interconnectedness, like the cells in a honeycomb. The "tantrix" we create each time we play is an image of the "great field of action." It is a map of energy lines. Like a hexagram, any tile could become any other tile through the writhing of lines and alterations in color, but this kind of transformation, crucial to the workings of the *Yi Jing*, is not necessary in Tantrix. Changes in energy are revealed in sequences of connected tiles, and in the tantrix as a whole.

The game begins with a tile in the center of the playing surface: a stone in the middle of the pool, and the ripples fan out from there. The safest first play is a tile that has a straight of our own color, for a straight cannot be quickly looped: it extends its arms expansively to the horizon in both directions. Play proceeds from the center, the tantrix growing outward, its edges like the sapwood of a tree, whose growth is largely determined by the grain and twist of the heartwood.

In the game of Tantrix, as in life, we are invited to consider the strategic importance of playing indirectly (as in the game of Go, where stones are often strongly connected even though they may be widely separated): of seeing energetic connections that are not yet substantial and mapping the steps necessary to make the link. We become aware, through the rules regarding three-sided spaces, that situations sometimes demand particular solutions, and will remain

unresolved until the right fit is found. We are reminded by the "controlled side" rule that events frequently must unfold in a certain sequence: socks first, shoes second.

Any tile can connect to any other single tile; but as combinations present two- and three-sided spaces, options for play are reduced. We learn there is always choice, but certain choices are better than others. Sometimes forced or unlikely choices turn out better than expected. Sometimes we must play in a way that is more advantageous to others; sometimes others are obliged to further our interests, or will inadvertently play in ways that favor us. We make grand plans and then discover what is feasible. Sometimes the beginner we are teaching winds up with a longer line than ours, no matter what we might have done. This is the great field of action.

CONSULTING THE YI JING

In this study I propose two methods for consulting the *Yi Jing* using Tantrix. One is the Random Draw Method; the other, which I call the Tantrix Game Method, takes full advantage of the game of Tantrix itself. I will begin by describing the divination process in general, focusing on the Random Draw Method.

Divination: The Random Draw Method

There are many methods for consulting the *Yi Jing*. There is the coin method, where three coins are thrown six times, one for each line, building from the bottom of a hexagram. There is the more ancient and venerable yarrow stalk method, in which dried yarrow stalks or a substitute such as bamboo skewers are divided and counted eighteen times. There are seed methods, bead methods, card and dice methods. There are Shao Yung's Plum Flower Mind and Marvelous Pillow methods, and others that use numerology, dates, and directional referents. We may also open the book "at random," though cracking the book usually opens to an inner page or a place where the binding is weakest, and readings may also be biased by the semi-conscious desire to avoid those sections.

Traditionally, a method of *Yi Jing* divination needs to select a hexagram at random and indicate which of its lines are changing. The well-known coin and yarrow stalk methods do this simultaneously, by making it possible to generate any of the four kinds of lines (yin, yang, "yang becoming yin," and "yin becoming yang") with the same operation. With these methods, the probability of obtaining each of the lines is different: 3, 3, 1, 1 for the common coin method, and 7, 5, 3, 1 for the yarrow stalk method. (An ingenious method invented by Mondo Secter utilizes three coins but does so with the same probabilities as the yarrow stalk method.) Sequential selection of two hexagrams is also effective, as the changing lines can be inferred by noting which lines would have to change in order for the first, or "current" hexagram to become the second, or "latent" one. *Tantrix becomes a divinatory tool simply by randomly drawing two tiles in succession from the Game Pack bag*. This is what I call the Random Draw Method.

Making the eight T.I. tiles.
A Game Pack provides 56 of the necessary 64 tiles. Since T.I. tiles are no longer produced or available, you must make the remaining eight tiles yourself. It is important that they feel the

same as the other tiles, so I recommend sacrificing a Discovery set (ten tiles) to the cause. Let Discovery 7 stand for T.I. 57, Discovery 8 stand for T.I. 58, Discovery 9 stand for T.I. 59, etc. Write the sequence of T.I. colors (see Table 15) on the line-ends clockwise around the Discovery tiles with a permanent magic marker. Of course, this method of divination may become so popular that demand for the eight obsolete T.I. tiles will spur the folks at Tantrix into producing them as a booster pack… ☺

The ritual of consultation.

The *Yi Jing* is a tool designed to help us cultivate and rely increasingly upon our intuition: our own inner wisdom. If we achieve clarity before we open the book, then the *Yi Jing* has accomplished its purpose. The goal is to foster a personal relationship with it, as if it were a friend whose opinion we value greatly. It is helpful to be respectful: our respect for the book is emblematic of our respect for ourselves, and of our own fundamental goodness and wisdom. It is helpful to be open to the possibility that wise counsel may come from a "random" event, like the drawing of a tile, for *chance* is the language through which the Sage (and life itself) speaks to us. Coincidence is just a word for a conjunction of events whose meaning and purpose we don't yet understand. It is not necessary, however, to *believe*. The Sage seems to enjoy surprising a skeptical mind!

1. Spend a few minutes in reflection. Is the situation you are considering uppermost in your mind/heart? If so, have you decided what course you will follow? If not, have you sincerely applied your intuition and other resources to the discovery of a solution? If so, and you still desire clarity and guidance, are you willing to abide the judgment? If so, proceed.

2. I recommend that you write freely for a few minutes about the situation you are considering. Let the words flow easily onto the page. It is possible that a satisfactory answer may come to you during this process, or a more precise focus might occur to you.

3. Formulate a clear, concise inquiry. It may be as simple as "what should my attitude and action be in this situation?" Or you may want to be more specific. The energy you put into your question returns to you in the energy of the answer. The clearer your inquiry, the easier it may be to interpret the guidance—time frame? action required? place? persons involved? Questions should be open-ended: questions that can be answered yes or no can be decided by the flip of a single coin. Write your inquiry on a clean sheet of paper.

4. Place before you a copy of the *Yi Jing* and your Tantrix tiles in their bag. Close your eyes for a moment and reconsider your inquiry. Throughout the divination process, either focus on your inquiry or keep your mind as receptive and free of thoughts as possible.

5. With your eyes closed, reach into the bag and scramble the tiles with your fingers. Draw one tile. Make a note of its number and contemplate its pattern. Look the tile up on the identification matrix (Table 18), and copy the hexagram lines onto your paper. This is your "current" hexagram: it customarily offers us insight into where we are now and how we got here; and a "current" runs through it. Read the text of the hexagram indicated. This may vary depending on the text you are using, but in the Wilhelm/Baynes version, this consists of an introductory paragraph, a section called "The Judgment" and a section called "The Image." Do not read the texts accompanying the individual lines… yet.

6. Return the first tile to the bag.

7. With your eyes closed, reach into the bag and scramble the tiles with your fingers. Draw a second tile. Make a note of its number and contemplate its pattern. Look the tile up on the identification matrix (Table 18) and copy the hexagram lines onto your paper. This is your "latent" hexagram: a projection based on energetic tendencies in the present.

8. Compare the two hexagrams and find out which lines must change in the current hexagram to produce the latent hexagram. Those are the lines you will now read about in the section called "The Lines" in the text of the ***current*** hexagram. These lines are considered "keys to action." Whether you follow the suggestions of the lines may determine to some extent whether you arrive at the situation pictured in the second, latent, hexagram.

9. Consider the text of all changing lines ("6s" and "9s"), but if you have two, give most weight to the upper one; if you have three, give most weight to the middle one. If you have four, note which ones are **unchanging** and read the corresponding lines in the ***latent*** hexagram, giving most weight to the lower one. If you have five, give most weight to the text of the unchanging line in the ***latent*** hexagram. If six, don't read any lines; give credence only to the text of the latent hexagram.

10. When you have finished reading the lines, go to the text of the latent hexagram and read the introductory paragraph, "The Judgment," and "The Image." Do not read the line texts in the latent hexagram (unless you had four or more changing lines). The latent hexagram is sometimes called the "future" hexagram, but this is a misnomer. The *Yi Jing*, as it is commonly used, doesn't foretell: it offers us insight into *possible futures* based on the "currents" in our present situation.

Admittedly, this could have been accomplished by writing the numbers 1 to 64 on slips of paper and drawing them out of a hat. But the tiles offer us more than this, as I propose in the next section.

Divination: The Tantrix Game Method

In this method two or more individuals agree to use *the game* as a means of consulting the *Yi Jing*. They each go through the process of formulating an inquiry, selecting a color, and playing the game together. To formulate an inquiry, please see steps 1-3 in the section "The ritual of consultation," above. Alternatively, only one player may be consulting; the other(s) may simply be playing the game. To begin a divinatory game, read on.

Drawing to determine your *current* (first) hexagram.
Remember to include your eight homemade T.I. tiles (see above), bringing the total number of tiles in the game bag to sixty-four. One at a time, each player who is consulting the *Yi Jing* draws a tile at random from the bag and records the number, suit, and pattern on paper. It must be possible for more than one player to draw the *same tile*, as the same hexagram may be derived for different inquiries; so each player must return their tile to the bag before the next player draws. This tile represents the *current* hexagram.

Drawing for first play and color.
All players draw a tile at random from the bag, this time keeping the tile in front of them. The player with the highest number will go first, as in the regular game. That player turns their tile over to reveal its suit; *the color missing from that suit will be that player's color*. The next player then turns their tile over and will play the color missing from that tile's suit. If both tiles

are from the same suit, the second player draws one tile at a time until they draw a tile from another suit. If only two are playing, player two keeps the last tile and returns all other tiles to the bag, after which the first player draws five more tiles, followed by the second player.

If more than two are playing, player two keeps the last tile and sets any other tiles drawn aside. Player three follows the same procedure for selecting a color, keeping the last tile. The fourth player plays the remaining color, keeping the tile they drew first regardless of its suit. Any tiles set aside by the second and third players are then returned to the bag and each player in turn draws five more tiles.

Creating a tantrix: "the great field of action."
Players then play a game, while continuing to contemplate their situation and inquiry. The tantrix they create under the benevolent guidance of the Sage is an image of "the great field of action." Colored lines, whether begun in the first or in a subsequent tile, may grow in either direction, directly or indirectly (one or more spaces between tiles that eventually join together), or they may grow as separate lines which eventually connect. As in life, origins and outcomes, causes and effects, may be difficult to determine. Players will eventually draw and play the tile(s) representing each player's current hexagram. They may be embedded within the tantrix or on the perimeter. *Players may place a coin or other small, personal marker on their current hexagram tile after it is played*.

Determining the *latent* (second) hexagram.
Any method that allows the Sage to select both current and latent hexagrams from the full range of possibilities is legitimate. The second hexagram may in fact be the *same hexagram as the first*, or it may be any of the other sixty-three hexagrams. The divinatory game must allow the possibility that players will receive the same current hexagram as other players, the same latent hexagram as other players, and the same hexagram for both current and latent hexagrams. The Tantrix Game Method described here permits these diverse results.

Loops.
In traditional divination, a reading will consist of a single stable hexagram only 20% of the time. In the Tantrix Game Method, this result is approximated by the rarer occurrence of loops versus lines. When a player's highest score in a divinatory game is achieved with a loop, the result of the divination is the single stable hexagram drawn at the start: current and latent hexagrams are the same, and there are no changing lines. The loop indicates that the energy of the situation is self-contained, whirling around itself in a relatively stable eddy. Yet the tile representing both will have been played somewhere in the tantrix, and is surrounded at the game's end by up to six proximate tiles, whose hexagrams it may be instructive to explore. No situation is absolutely closed; all things are changing, even if imperceptibly.

Lines.
When the scoring feature is a long line rather than a loop, a tile at one end or the other will represent the latent hexagram. Tantrix lines have two ends which open onto the sides of the mosaic. At the conclusion of the game, one or both of these ends may be either open or blocked. An end may be blocked in three ways: it may enter an unfillable three-sided (forced) space, it may curl back toward the mosaic into an unfillable space, or it may be blocked by an opponent's

placement of a blocking tile. (For our purposes here, an "open" end is one that may either stand out from the mosaic so that another tile could be played on it without touching any other tile, or it may be on the edge of the mosaic in a *two-sided* space, so that another tile could be played on it and only touch it and one other tile.)

Which tile represents the latent hexagram depends on the scenario that confronts us at the end of the game. In order of precedence, the alternatives are:

Open End(s)
    1) the last tile on the end of the line *furthest* from the placement of the current hexagram tile if both ends of the line are open;
    2) the last tile on the open end of the line if only one end is open.

Blocked End(s)
    3) the tile nearest to the unfillable forced space which could (if it were still in play) fill that space, at the end of the line *furthest* from the player's current hexagram tile if both ends enter forced spaces;
    4) the tile nearest to the unfillable forced space which could (if it were still in play) fill that space, if the other end is blocked in another way;
    5) the tile facing the end of the line curling back onto the tantrix (the tile one or more "straights" would touch if extended from the line), at the end *furthest* from the player's current hexagram tile if both ends curl back;
    6) the tile facing the end of the line curling back onto the tantrix if the other end is blocked by an opponent's deliberate placement of a blocking tile.
    7) the tile deliberately placed by an opponent to block the end of the line furthest from the player's current hexagram tile, if both ends are blocked by such placements.

These alternatives permit the current and latent hexagrams to be the same (especially #3 and #4) as in the case of a loop; and they permit more than one player to wind up with the same latent hexagram (especially 3, 4, 5, and 6). Thus, in the choosing of both current and latent hexagrams through a divinatory game, all possibilities are open to the Sage.

Context.
The tile or tiles you receive as your answer are embedded in a mosaic of other tiles which, because they are intertwined, exert an influence on the situation, and can be included in the reading. So a *full reading* using the Tantrix Game Method involves three aspects:
    1) the text associated with the one or two subject tiles;
    2) the text associated with tiles along the primary energetic ley line (the line of a player's color), especially if one or both ends are open; and
    3) the text associated with the surrounding *context tiles*.

Single tiles may be surrounded by up to six other tiles, and these adjacent tiles exert an influence on subject tiles. Extension of the interpretation into the contextual matrix necessitates greater understanding of the hexagrams, deeper contemplation, and more time than a regular

consultation. Give it a try. You may simply peruse all the hexagrams represented by the context tiles and let your intuition determine their significance.

The Tantrix Game Method generates a standard reading of one or two hexagrams; but it also provides us with a graphic depiction of the complex web of energy always present in the real world, and invites us to take a three-dimensional virtual tour through the rooms within and around our situation. Even with multiple inquiries, there is no protocol in traditional *Yi Jing* consultation for obtaining a context this rich.

CONCLUSION

Tantrix did not emerge in pre-history as a means of reading energy in order to understand life, the way of nature, and the flow of time, as did the *Yi Jing*. Tantrix was not designed to be deep, just comprehensive within the parameters of four colors and hexagonal shape. But its use of color in a 2^6 binary model hinted that an exploration of the *Yi Jing* grounded in the visible light spectrum might provide new insight. What has come of this for me is an appreciation of the depth of association hidden in the game, and communion with the playful spirit of the "little old Sage in the yellow robe." In both there is that wonderfully Daoist dichotomy: that which seems simple can be the most complicated, that which seems complex may turn out to be simplest:

> "By means of the easy and the simple we grasp the laws of the whole world. When the laws of the whole world are grasped, therein lies perfection" (The Great Treatise, *Wilhelm YJ* p. 287).

The world changes as our impression of it, as our impression on it, changes. We sort the stalks, we draw the tiles, we play the game, and the loose mosaic evolves: pathways taken and not taken, relationships shifting, connections leading off in new directions—a line pursued sometimes looping us back to beginnings. Each moment, each tile a colored grain contributing to a fantastically intricate vision of vast worlds: like an exquisite Tibetan sand mandala, the making of which is meditation and prayer. In the next moment, the ephemeral pattern is swept away, for that too is part of the process. Acceptance of change and loss opens us to the next moment, and the next: releases us from old patterns so that we might be receptive and attentive to possibility as the mandala unfolds again, like the powdery wings of a butterfly.

TILE	*HEX*	TILE	*HEX*	TILE	*HEX*	TILE	*HEX*
1	*50*	17	*49*	33	*47*	49	*32*
2	*31*	18	*28*	34	*23*	50	*44*
3	*34*	19	*37*	35	*43*	51	*24*
4	*10*	20	*25*	36	*17*	52	*22*
5	*12*	21	*64*	37	*38*	53	*4*
6	*14*	22	*41*	38	*39*	54	*27*
7	*5*	23	*63*	39	*7*	55	*45*
8	*26*	24	*53*	40	*13*	56	*35*
9	*8*	25	*61*	41	*18*	(57)	*2*
10	*3*	26	*54*	42	*16*	(58)	*52*
11	*6*	27	*46*	43	*19*	(59)	*51*
12	*36*	28	*62*	44	*9*	(60)	*29*
13	*11*	29	*40*	45	*33*	(61)	*30*
14	*20*	30	*59*	46	*48*	(62)	*57*
15	*56*	31	*21*	47	*55*	(63)	*58*
16	*60*	32	*15*	48	*42*	(64)	*1*

Table 16: *Tantrix Tiles and their Associated Hexagrams*.

3rd:
3 m-pairs or alternating yin/yang lines? → NO →
YES → **ROND**

Line Pairs	Hex	Tile	Clockwise
yin m-pr top	34	3	BBYYRR
yang m-pr top	20	14	BBRRYY
yin m-pr middle	61	25	BBGGRR
yang m-pr middle	62	28	BBRRGG
yin m-pr bottom	33	45	BBGGYY
yang m-pr bottom	19	43	BBYYGG
3 c-prs "6" bottom	63	23	GGYYRR
3 c-prs "9" bottom	64	21	GGRRYY

Place of odd m-pr: Suit short λ (BGY)=Earth next λ =Mid, next Sky. Corners in VLS order= m-pair is yin. Longest λ (GYR)= alt yang/yin

◀ **ROND**

Any Hexagram

2nd:
5 yin or 5 yang lines? → NO →
YES → **CHIN**

Lines	Hex	Tile	Str/Bnds
yang at top	23	34	R/GY
yin at top	43	35	Y/GR
yang in 5th	8	9	R/BY
yin in 5th	14	6	Y/BR
yang in 4th	16	42	R/BG
yin in 4th	9	44	Y/BG
yang in 3rd	15	32	G/YR
yin in 3rd	10	4	B/YR
yang in 2nd	7	39	G/BR
yin in 2nd	13	40	B/GR
yang in 1st	24	51	G/BY
yin in 1st	44	50	B/GY

Straight Odd Line
R= yang in top 3
G= yang in bot 3
Y= yin in top 3
B= yin in bot 3
Av bend λ = place

◀ **CHIN**   ◀ **Any Tile**

1st:
same trigram top & bottom? → NO →
YES → **T.I.**

Trigram, bot up	Hex	Tile	Clockwise
yin-yin-yin	2	(57)	YBG-YBG
yin-yin-yang	52	(58)	BYR-BYR
yang-yin-yin	51	(59)	GBY-GBY
yin-yang-yin	29	(60)	BRY-BRY
yang-yin-yang	30	(61)	RBG-RBG
yin-yang-yang	57	(62)	YRG-YRG
yang-yang-yin	58	(63)	RGB-RGB
yang-yang-yang	1	(64)	GRY-GRY

No R: Kun & Zhen (6s)
No Y: Li & Dui (7s)
No G: Kan & Gen (8s)
No B: Qian & Sun (9s)
G on top: Kun, Li, & Sun
Y on top: Qian, Kan, & Zhen

◀ **T.I.**

Table 17a: *Hexagram to Tile, Tile to Hexagram Conversion Key*.
(Place Table17a below 17b so that "1st, 2nd, 3rd, 4th" under Any Hexagram line up in order.)

Any Hexagram

4th:

2 m-pairs?

YES → **BRID**

NO → **SINT**

sum of pairs' λ values	m-pair	Hex	Tile	corner/bends
5	top	40	29	R/BG
6	"	46	27	R/GB
7	"	36	12	R/BY
8	"	6	11	R/YB
9	"	25	20	R/GY
10	"	37	19	R/YG
5	middle	4	53	Y/BG
6	"	27	54	Y/GB
7	"	3	10	Y/BR
8	"	50	1	Y/RB
9	"	28	18	Y/GR
10	"	49	17	Y/RG
5	bottom	35	56	B/GY
6	"	45	55	B/YG
7	"	39	38	B/GR
8	"	38	37	B/RG
9	"	26	8	B/YR
10	"	5	7	B/RY

3 c-pairs trigram:

	Hex	Tile	
mountain	22	52	G/BY
thunder	48	46	G/YB
water	17	36	G/BR
fire	18	41	G/RB
wind	21	31	G/YR
cloud	47	33	G/RY

SINT → **Any Tile**

A. Corner (m-pr): R=top, Y=mid, B=bot.
B. Aver λ of bends=sequence of tiles.
C. Blue end 1st, & "Blue-er" top bend 1st.
D. Hex seq= sum of λ for line pairs: 5-10
   ⚏ =(1); ⚎ =(2); ⚍ =(3); ⚌ =(4)
E. Match Blue end of both.

c-pr top "6":	Hex	Tile	Str/Cors
• yin m-pr above	60	16	Y/GR
• yin m-pr under	31	2	B/YR
c-pr top "9":			
• yang m-pr under	41	22	G/YR
• yang m-pr above	56	15	R/GY
c-pr middle "6":			
• yin m-pr above	11	13	Y/BR
• yin m-pr under	53	24	B/GR
c-pr middle "9":			
• yang m-pr under	54	26	G/BR
• yang m-pr above	12	5	R/BY
c-pr bottom "6":			
• yin m-pr above	55	47	Y/BG
• yin m-pr under	42	48	B/GY
c-pr bottom"9":			
• yang m-pr under	32	49	G/BY
• yang m-pr above	59	30	R/BG

BRID

Relative m-pr places
yang m-pr above
yang m-pr below
yin m-pr above
yin m-pr below
Corner aver λ = c-pr powr place

Straight
R= ⚎
G= ⚍
Y= ⚏
B= ⚌

Table 17b: *Hexagram to Tile, Tile to Hexagram Conversion Key*.

Trigrams Upper ➤ / ⩔ Lower	KUN	GEN	ZHEN	KAN	LI	SUN	DUI	QIAN
KUN	Hex 2 T.I. YBG	Hex 23 Tile 34	Hex 16 Tile 42	Hex 8 Tile 9	Hex 35 Tile 56	Hex 20 Tile 14	Hex 45 Tile 55	Hex 12 Tile 5
GEN	Hex 15 Tile 32	Hex 52 T.I. BYR	Hex 62 Tile 28	Hex 39 Tile 38	Hex 56 Tile 15	Hex 53 Tile 24	Hex 31 Tile 2	Hex 33 Tile 45
ZHEN	Hex 24 Tile 51	Hex 27 Tile 54	Hex 51 T.I. GBY	Hex 3 Tile 10	Hex 21 Tile 31	Hex 42 Tile 48	Hex 17 Tile 36	Hex 25 Tile 20
KAN	Hex 7 Tile 39	Hex 4 Tile 53	Hex 40 Tile 29	Hex 29 T.I. BRY	Hex 64 Tile 21	Hex 59 Tile 30	Hex 47 Tile 33	Hex 6 Tile 11
LI	Hex 36 Tile 12	Hex 22 Tile 52	Hex 55 Tile 47	Hex 63 Tile 23	Hex 30 T.I. RBG	Hex 37 Tile 19	Hex 49 Tile 17	Hex 13 Tile 40
SUN	Hex 46 Tile 27	Hex 18 Tile 41	Hex 32 Tile 49	Hex 48 Tile 46	Hex 50 Tile 1	Hex 57 T.I. YRG	Hex 28 Tile 18	Hex 44 Tile 50
DUI	Hex 19 Tile 43	Hex 41 Tile 22	Hex 54 Tile 26	Hex 60 Tile 16	Hex 38 Tile 37	Hex 61 Tile 25	Hex 58 T.I. RGB	Hex 10 Tile 4
QIAN	Hex 11 Tile 13	Hex 26 Tile 8	Hex 34 Tile 3	Hex 5 Tile 7	Hex 14 Tile 6	Hex 9 Tile 44	Hex 43 Tile 35	Hex 1 T.I. GRY

Table 18. *Identification Matrix for Yi Jing Hexagrams and Tantrix Tiles.*
Trigrams on the left and top are matched to the section of the Visible Light Spectrum with which they are associated in this study. T.I. tiles (the obsolete "Triple Intersections") are indicated by the sequence of their colors.

GLOSSARY

Brid. short for "bridge," one of five Tantrix tile patterns.

Changing Lines. Lines in a hexagram that are currently either yin or yang, but are about to change into their opposite. The two changing lines are Six (6): "yin becoming yang," and Nine (9): "yang becoming yin."

Chin. short for "Chinese character," one of five Tantrix tile patterns.

Complementary Pair. Two adjacent lines in a hexagram where one is yin and one is yang. Abbreviated "c-pair" in this study. (see also "Matched Pair").

C-Pair. see "Complementary Pair."

Matched Pair. Two adjacent lines of one type in a hexagram: two yin lines, or two yang lines. Abbreviated "m-pair" in this study. (see also "Complementary Pair").

M-Pair. see "Matched Pair."

Nine (9). See "changing lines."

Pinyin. See "Romanization."

Romanization. Representation of Chinese language with the Latin alphabet. Various systems have been employed. The Wilhelm/Baynes edition of the Book of Changes uses the Wade-Giles system, and therefore romanizes the title "I Ching." *Pinyin*, the official system in the PRC, is now superseding all previous systems, and I use *pinyin* throughout this study.

Rond. Short for "roundabout," one of five Tantrix tile patterns.

Sint. Short for "single intersection," one of five Tantrix tile patterns.

Six (6). See "changing lines."

Suits. There are four "suits" in Tantrix, each of which has 14 tiles (2 Ronds, 3 Brids, 3 Chins, and 6 Sints) and three of the four colors: B-G-Y (No Red), B-G-R (No Yellow), B-Y-R (No Green), G-Y-R (No Blue).

Tantrix. A trademark of Tantrix Games Ltd. Brand name of a set of hexagonal tiles with three line types in four colors. Also, when lowercase, the mosaic formed by connecting Tantrix tiles. Said to have been derived from "tangled tracks."

Three-Power Positions. The three pairs of lines in a six-line hexagram associated with the Chinese concept of "three powers" (*san cai*): Earth (the bottom line and the second line), Humanity (or all living beings, lines 3 and 4), and Sky (line 5 and the top line).

Triple Intersection (T.I.). The fifth Tantrix tile pattern, consisting of three straight lines, each of which connects opposite sides of a six-sided tile. Though part of the Tantrix set until 1992, this pattern was removed because it impeded game play. Nevertheless, the 8 possible T.I.s are integral to the set's binary nature, and so are included in this study.

Wavelength. The distance from the peak of one wave to the peak of the next; the wavelength of electromagnetic radiation is usually expressed in nanometers (nm: 1 nanometer = one billionth [10^{-9}] of a meter). The symbol for wavelength is the Greek letter lambda: λ.

REFERENCES

Achilles, Constance. "Color and the Trigrams: The Masculine and Feminine Colors." in <u>Fulcrum: The Science</u>
<u>Journal of the University of Science and Philosophy</u>, v.2, n. 3, Feb 1994, pp. 13-29.
[Nicely worked out, but arrives at different color assignments as she focuses on the trigrams and uses more
colors. Also available on-line at: http://www.anton-heyboer.org/i_ching/trigrams/bigpattern-connie.htm]

Anthony, Carol K. <u>A Guide to the I Ching</u>. Stow MA: Anthony Publishing Co., 1988.

Dhiegh, Khigh Alx. <u>The Eleventh Wing: An Exposition of the Dynamics of I Ching for Now</u>. Dell Publishing Co.,
1973.

Dyer, Dave. Website: http://www.andromeda.com/people/ddyer/tantrix/TantrixTips.html

Graham, Helen. <u>Discover Color Therapy</u>. Ullysses Press, 1998.

Harbaugh, Rick. <u>Chinese Characters: A Genealogy and Dictionary</u>. Zhongwen.com, 1998.

Jones, Chris Brierley. Website: http://www.users.bigpond.net.au/Chris.Jones/Tantrix/tantrix.htm

Jou, Tsung Hwa. <u>The Tao of I Ching: Way to Divination</u>. Tai Chi Foundation, 1984.

Mitchell, Stephen. <u>The Tao Te Ching</u>. Harper and Row, 1988.

Panzer, Karsten K. Website: http://www.perzan.de
[See especially "The Colors of Genes" Lecture at the World Conference on Arabidopsis Research by K.
Panzer Perzan; and "PerZan: I-Ging & Genetic Code." Integration of art and science, interesting to me in
that, though this application uses white for Qian and black for Kun, we agree on the placement of dark blue
at Gen, yellow on the left and green on the right of the Fuxi diagram.]

Scherphuis, Jaap. "Jaap's Puzzle Page:" http://www.geocities.com/jaapsch/puzzles/tantrix.htm

Schoenholtz, Larry. <u>New Directions in the I Ching: The Yellow River Legacy</u>. Secaucus NJ: University Books,
1975.

Schonberger, Martin. <u>The I Ching and the Genetic Code: The Hidden Key to Life</u>. D.Q. Stephenson, trans. NY:
ASI Publishers Inc., 1979.

Secter, Mondo. <u>I Ching Clarified: A Practical Guide</u>. Charles E. Tuttle, 1993.

Tantrix. Website: http://www.tantrix.com
[the official site and on-line game]

Wieger, L. <u>Chinese Characters</u>. L. Davrout, trans. New York: Dover Publications Inc., 1965.

Wilhelm, Richard, and Cary F. Baynes, trs. <u>The I Ching or Book of Changes</u>. Third Edition. Princeton: Princeton
University Press, 1967.
[Cited throughout this study. First published in 1950, it has been the standard in the West since then.]

Yan, Johnson F. <u>DNA and the I Ching: The Tao of Life</u>. North Atlantic Books, 1991.

Websites on the visible light spectrum:
http://hyperphysics.phy-astr.gsu.edu/Hbase/ems3.html
http://www.glenbrook.k12.il.us/GBSSCI/PHYS/CLASS/light/u12l2b.html
http://acept.la.asu.edu/PiN/rdg/color/color.shtml