

声易经 Shēng Yì Jīng (Book of Sound Changes): A Comparison of Spectromorphology and 声易学 Shēng Yì Xué (Sound Changes Study)

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ABSTRACT

This paper posits that there is a mapping between the Yi-jing (YJ) symbolic domain of change and the spectromorphological (SM) domain of sonic forms. Such a demonstration can substantiate the ontological terrain and primary categories of sonic states and their transformations. Spectromorphology emerged out of an empirical/phenomenological method as bound to sonic material, while being shaped by categorical, symbolic and historical considerations. The Yijing arose from a much longer relationship with a method of describing the abstract states and processes of change itself, independent of material or contextual application - determining its object or context at the time of reading or consultation. In this paper, I touch on the basic concepts that situate this study and how it might be applied in a prescriptive musical context (notation).

1. INTRODUCTION

声 (sheng) means sound, 易 (yi) means change, 经 (jing) means book, 学 (xue) means study. 声易学 (sheng yi xue) 'sound change study,' could directly translate to spectromorph-ology. Morph means form or shape. Morphology refers to the study of forms; spectro-morph-ology: the study of sound forms. Meta-morphosis or morpho-genesis means change or generation of form, respectively.

To orientate the reading, in the following image, we see one example of a possible correlation between the Yijing hexagram Cui, *Clustering* and the spectromorphological graph of *Bulging*. A catalogue of such mappings aims towards a 声易经 (Sheng Yi Jing) or Book of Sound Changes.



Figure 1. Mapping YJ hexagram Cui to the SM symbol for bulging.

Form and change are related such that without form there can be no change and conversely, without change there can be no form. It would be a neat characterization to say that morphology is focused more on 'transformation of forms,' while the yijing system is focused more on 'forms of transformation;' but this has to be investigated. The premise of this project is that a comparative study of the Yijing as applied to the domain of spectromorphological concepts will unfold clear correspondences between the two domains. The YJ is thousands of years old, while SM is a relatively young field, yet this paper aims to show that the comparison can lead to mutual insights.

2. PROBILITY SPACE OF CHANGE

One could look at the field of all possible sound change as a probability space.

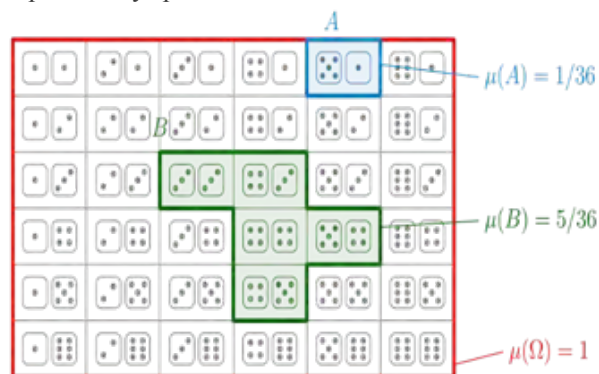


Figure 2. Probability space from https://en.wikipedia.org/wiki/Probability_space.

Let's look at the rules that formalize a generic probability space:

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- All possible outcomes are called the ‘sample space.’
- An ‘event’ is one particular outcome.
- Divide the number of event(s) by all possible events which will equal the ‘probability measure’

In a similar way, Let the 64 Hexagrams of the Yijing to represent the *probability space* of sound changes.



Figure 3. Yijing hexagrams as a probability space.

Considering the hexagrams to represent sonic transformations, we can call the probability of all sound changes the ‘*sample space*,’ that which represents any one particular abstract change schema an ‘*event*’ and the probability for that change to occur, the ‘*probability measure*.’ Further on, we can call a larger set of changes a ‘performance event.’

One can look at the ancient text of the Yijing (易经) in terms of the Chinese equivalent of probability theory.

3. BACKGROUND

This section looks very generally at some underlying dynamics of the system of the Yijing as it might relate to a scientific understanding in general or field and wave phenomenon in particular.

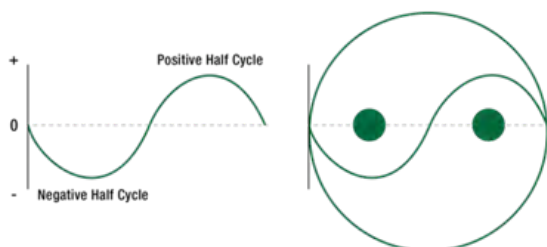


Figure 4. Sine wave compared to the Taiji symbol.

¹ The Yizhuan or Dazhuan, translated as the *Great Commentary* of the Yijing. Attributed to Confucius or disciples.

It is said in the Yizhuan¹ “Conjunction and alteration of yin and yang (阴阳) is called the dao (道)” [1, p. 517].

The interaction of yin and yang is the way things are formed and transformed; such is the essence of change or yi (易). Compare this to a famously attributed (dubious) quote to Einstein that, “everything in life is vibration.” In any case, this is a fundamental premise in physics.

There is a striking correspondence between Chinese metaphysics and quantum theory. In physics there is the vacuum, or ether, or dark energy, which could correspond to the Chinese concept of *Tàixū* (太虛) – or ultimate void – a complex term originating with Zhang Zai (1020-1070) as a refutation of Laozi’s conception of nothingness (wu). “*Taixu* contains qi... *taixu* is in both the dispersion and the coalescence of qi... one thing but two states (yi wu liang ti - 一物兩體)” [2, p. 47]. It is then straightforward to extend this concept to the fundamental energetic particles/fields (two states) of quantum theory. Qi is therefore a complex configuration of energies.

When considering the structuration of physical or biological matter by fields of energy (morphogenesis), we have the concept of *Lǐ* (理) in Chinese - *pattern*: holding that “there is no energy that is not patterned” or that “qi functions as emergent organizations of energy (氣之理 qi zhi li)” [3, p. 82]. Wang Fuzhi writes (400 years ago) following Zhang Zai (1000 years ago): “Patterning moves within qi. There is nothing that is not constituted by Qi, so there is also nothing that does not have pattern” [Ibid, p. 82]. This patterning is created out of the polarity of Yīnyáng (阴阳) and continually changes/evolves as subject to the nature of Gǎnyīng (感应 resonance).

This process of patterning as represented in the symbolism of the Yijing, distinguishes three kinds of change in general: no change, cyclic change and sequential change. Movement and rest have their definite laws according to these firm and yielding lines and are differentiated and motivated by energetic polarities [4, pp. 833-34].

4. SPECTROMORPHOLOGY

The philosophy of form and transformation in the West has ancient roots as well (Platonic forms and a persistent cultural/philosophical polarity of a different sort: ideal-real). Not by chance, this dialectic of form plays out well in the early history of electroacoustic music in the

theoretical approaches of musique concrete and spectromorphology [5, 6]. The concrete/discrete approach of Schaeffer focuses on the physical-phenomenological characteristics of sound objects (the real), while Smalley's SM leans more towards the abstract/reduced (ideal) by identifying sonic structure through the analytic bifurcation of their spectral and energetic (temporal) components. Both methods tend ultimately toward listening and categorization which this project hopes to cross-culturally extend further.

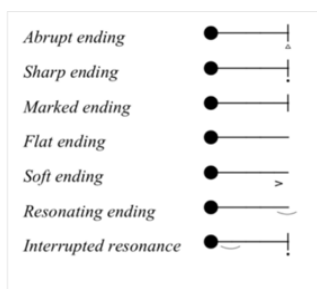


Figure 5. Offset genres. Image from auralsonology.com [Online]: Accessed January 2023.

As a broad sociological project spanning decades, the spectromorphological symbolic system has become hybrid and extended, coalescing into an organized language for describing sound shapes, spectra, and transformations. It classifies the abstract properties of amplitude, duration and spectra; onsets, continuants, terminations; motion and growth; harmonic or density, and more [7]. The graphs can be deployed in analysis or composition, or are, for taxonomists, interesting in themselves.

	Facility	Spontaneity	Sequential	Harmonic	Interval	Complex	Accented
STABLE							
Faceted	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰
Dynamic	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰
Complex (epitaphic)	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰
VARIABLE							
Faceted	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰
Dynamic	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰
Complex (epitaphic)	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰	☰☰

Figure 6. Spectromorphological categories. Image from auralsonology.com. [Online] Accessed January 2023.

The 21st century brings with it new frameworks to challenge spectromorphological approaches, experimenting with embodied, acoustemological, ecstatic, indigenous or even phonosophical approaches [8]. Also, a better understanding of the latest scientific perspectives can be, paradoxically, an opening to ancient modes and approaches that are non-mechanistic and less sonic materialistic.

5. THE YIJING

In comparison to SM, the Yijing utilizes a system of hexagrammatic graphs (comprised of six binary yin/yang lines) with associated symbols and poetic imagery: the chinese characters and evocative scenes (treading on a tiger's tail). The symbols represent "all possible configurations of change in nature and in human life." [9, p. 1]. The situational images are abstract - to be applied in specific frameworks, contexts or situations. Here, they are applied to organized sounds.

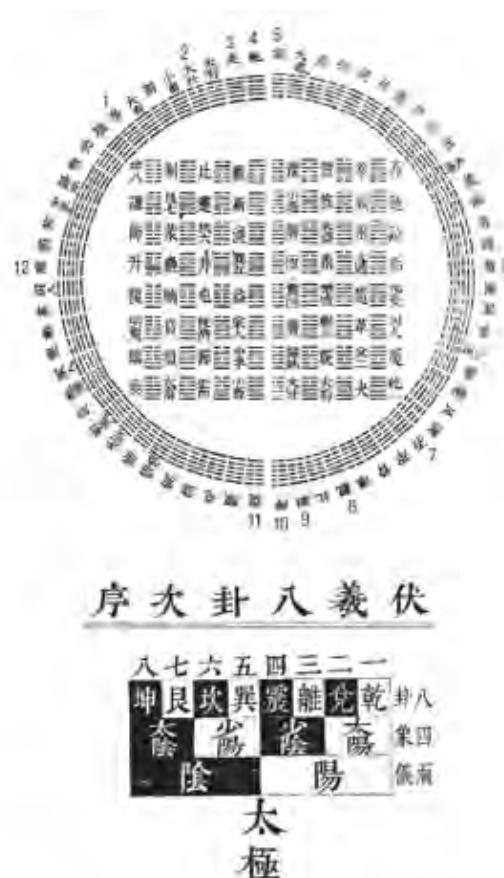


Figure 7. Hexagram sequence of Fuxi, the mythic creator of the Yijing [9, p.27].

A 3000 year history of 'Guān' (观) or 'comprehensive observation' has led to the formation of the Guà 卦 (tri-/hexagrammatic symbolic system), and their many layers of interpretation. When you look at any particular hexagram, you are looking into a virtual space, or house, that has been visited by generations of scholars over the centuries. On the walls of each space hangs their analytical poems, paintings, or commentaries written in thoughtful moments or in consideration of dire situations. The Yijing, while built on a binary-based arithmetical scaffolding, is lush and overgrown with the vines of deep organic/historical experience.

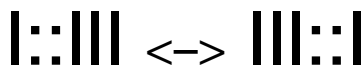
6. HEXAGRAMS

In considering this virtual probability space of sound changes (声易 sheng yi), the hexagrams are reoriented horizontally rather than vertically, in order to consider them from an aspect of resonance, left-right symmetry and from a perspective of mutual relationality.



Figure 8. Horizontal orientation of hexagrams allows for emphasizing symmetry rather than hierarchy.

In the horizontal aspect, hexagrams can be weighed as a symmetry, rather than heaven-above and earth-below, or superior and inferior positions. Secondly, we find that 56 of the hexagrams are actually mirrored by their adjacent hexagram - according to their order of listing in the Book of Changes. In other words, they come in pairs and as such form conceptual continua. This is similar to what is known as hexagram fluctuation, or Guà biàn 卦变 as noted by the philosopher Zhu Xi. For example, hexagram pair 25 (Wuwang 无妄, Without Entanglement) and 26 (Dachu 大畜, Great Accumulation) reveal a mirror symmetry:



No	Gua	SC	Pinyin	TC	English	Eranos	Legge	Wilhelm	side
25	无妄	无妄	wú wàng	无妄	Without Falsehood	Without Entanglement	Correctness, Innocence	Innocence [The Unexpected]	::
26	大畜	大畜	dà chù	大畜	Great Accumulation	Great Accumulation	The Great Taming Force	The Taming Power of the Great	::

Figure 8. Mirror hexagrams 25 and 26, Wuwang and Da Chu, represents a continuum of entanglement.

To illustrate the above, the paired sonic archetype as represented by hexagrams 25/26, represents the idea of non-entanglement to full entanglement.

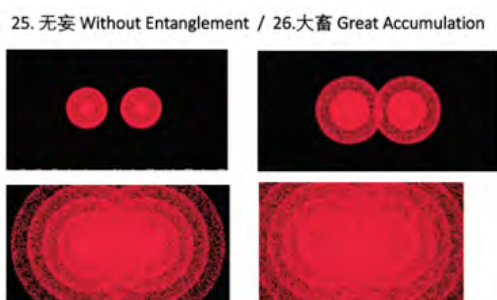


Figure 9. Illustration of the continuum of entanglement.

In total, 56 mirrored adjacent hexagrams are paired based on left-right reversal. The other 8 hexagrams are self-symmetrical or mirrors of themselves (such as ||::|| or :|||:). As pairs, 56 hexagrams are reduced to 28 archetypal concepts plus eight self-symmetrical hexagrams derive 36 sonic archetypes. Interestingly and perhaps non-incidentally, Schaeffer's TARTYP, which is "intended to present a presumably all-encompassing typology of sound objects" breaks down into 28 categories! [7, p. 3).

7. PUTTING SYSTEM TO SCORE

The guqin is an ancient Chinese instrument. An antiquated notation system that exists for the guqin is based on a system of 'reduced characters' (减字谱 jianzi pu). The system assembles a complex music gesture by indicating a string number, fret position, right hand plucking technique and left hand movement. Immediately, we are struck by the similarity of the idea of Schaeffer's "Typological Formulae" to indicate the "interdependence of a group-object and its constituent parts" [5, p. 372]. Six sections of the reduced character are filled in by simplified radicals as indicated on the following diagram [10].

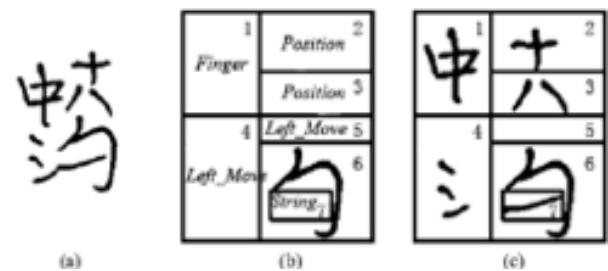


Figure 10. Schema of a reduced character for ancient guqin notation.

While the Sheng Yijing aims to be a general theoretical framework, the reduced character may be a natural solution to translate a hexagram into a six-part formulary to communicate more detail to a performer. But the underlying computer representation would indeed be a more mathematized specification as illustrated in Schaeffer's TOM [5, p. 373]. The Chinese radicals that comprise the displayed character would not indicate guqin gestures necessarily, but rather would represent more broadly sheng yixue / spectromorphological gestures - so that any instrument(s) could perform the score.

For example, while slot 6 (see diagram above) indicates a string number and pluck technique for a guqin, for our system, we could insert the Yijing character here which corresponds to a symbolic sound function (i.e. accumulation). Slots 1-3 might indicate the onset of a pitched or dystonic event and a transformation (pitch envelope of the center frequency of an EQ filter). Slots 4 and 5 might

refer to gait and offset/release. This part of the system is yet to be determined.

Currently we are working with brainwave sensors to trigger the symbolic events - hexagram choice. We have started working with mappings - from brainwave event, to Yijing probability space and finally to reduced character that indicates the sonic gesture for the performer. Of course, a brainwave controller is just one way (much more complex than necessary perhaps) to trigger sonic events. That said however, the brainwave sensor output is a multichannel system of neuronal energy flux, which has its own potentialized change space within which we can look for further correspondences between mind, brain, change states and symbolic sonic event.

8. CONCLUSION

This paper has introduced a Chinese approach to sonic description based on its own internal philosophical tradition, the Yijing. Quoting Wang Fuzhi: “The function of nature (tian 天) to enact transformations is qi. Its transformations achieved in the way (dao 道) are patterns (li 理)” [3, p. 82].

Spectromorphology is a system for describing electroacoustic sound shapes and epitomizes the traditional Western approach to sonic description through abstraction and categorization.

The YJ is a process-based system encased within an arithmetical scaffolding. We analogized the hexagrammatic space to a probability space of sound changes. We found possible mappings between the Yijing and spectromorphological categories. An important concept in Chinese philosophy is resonance or Ganying 感应 (resonance) which creates flux and movement in a polarized configuration of yin and yang. We begin to explore the resonance between the YJ and SM.

Work has begun on a score system to communicate the shengyi (sound changes) meanings to performers. The reduced character technique is one possible solution for enhancing or reinforcing the abstract nature of the shengyijing system. The simplified radicals in their appropriate slots act as a sonic gestural alphabet, similar to Schaeffer’s formulae, to translate the words of the shengyijing images.

Finally, a toss of the coins finds that the space of dispersion-restraint (涣 huan and 节 jie) leads to the perilous pit of darkness. So at this early stage of this project, one would be advised not to venture a definitive conclusion. In general, spectromorphology is deployed in the mode of description more often than it is applied in prescription

(notation); more as an analytical apparatus. The Yijing has traditionally been consulted as prognosticative of events and actions; more as a prescriptive apparatus. Thus the Sheng Yijing (Book of Sound Changes) might prove a better system for sound notation for performers, rather than as a precise tool for sound analysis.



Figure 11. Yi (Sound Change). New composite Character designed by Zhang Ruibo.

9. REFERENCES

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