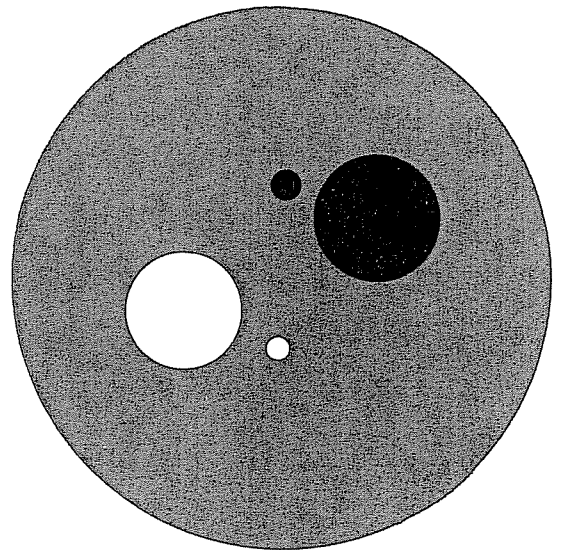


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CULTURE, MYSTICISM & SOCIAL STRUCTURE
AND THE CALCULATION OF BEHAVIOR

by

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ABSTRACT

CULTURE, MYSTICISM & SOCIAL STRUCTURE

AND THE CALCULATION OF BEHAVIOR

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An example is presented, drawn from Chinese culture, in support of a model for human cognitive processing which assumes that a major component of the rules for calculating human behavior are resident outside the individual in the symbolic artifacts of culture. An 'Appositional Transformation Operator,' or ATO is specified that can relate semantic concepts and patterns of behavior by analogy. The ATO is shown to work for verbal and visual analogies. The I CHING, a philosophical divination mechanism of classic Chinese culture, is shown to be constructed on the basis of an ATO logic. This analysis is intended as part of a cross-cultural validation of a theory which posits that ATO's are the basis for human calculation of behavior by analogy and for perception and use of metaphor.

CULTURE, MYSTICISM & SOCIAL STRUCTURE
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0. Introduction

I wish to present an example, drawn from Chinese culture, in support of a model for human cognitive processing which assumes that a major component of the rules for calculating human behavior are resident outside the individual, in the inherited, collective phenomena that anthropologists call 'culture' (Klein et al. 1981). The model contains rules of behavior encoded as analogical operators that relate situational state descriptions. This kind of operator has been named, 'Appositional Transformation Operator,' or AT0 (Klein 1977), and the term refers to a theory, derived from split-brain research, which posits that the division of labor between propositional and appositional modes of reasoning is culturally determined (TenHouten & Kaplan 1973; Paredes & Hepburn 1976, 1977). The AT0's I have described (Klein 1977) are derived from the 2-valued, strong equivalence operator of mathematical logic, and from a 3-valued variant. They can be used to calculate behavior by analogy, and in a way that evades many combinatorial problems associated with computation using propositional forms of rules. AT0's that link serial sequences of behavioral situations may, themselves, be interpreted as situation descriptions and related to each other by higher order AT0's, which, in turn, may be treated similarly. Computation with such higher order systems of AT0's makes it possible to handle goal related planning in particularly efficient ways.

¹ This paper is dedicated to the memory of Chen Shih Hsiang (UC-Berkeley), who, in another era, encouraged my attempt to persuade him that the West had produced something of merit (Klein 1956).

The interpretation of AT0's as situation descriptions often yields a kind of surrealistic imagery. In "Surrealistic Imagery & the Calculation of Behavior" (Klein et al. 1981), it was posited that many of the AT0's of a given society are encoded in the material and symbolic artifacts of its culture, yielding the thesis that 'culture' actually serves as a repository for the AT0's that make computation of behavior a feasible task for human automata. That paper supplied a formal specification of AT0 structure and a series of examples of their use in calculating solutions to verbal and visual analogy problems. It was then demonstrated that, if a visual analogy problem were given a verbal model interpretation, the analogies calculated through the use of AT0's remained valid in both domains. These examples were then followed by examples of complex analogies among complex behavioral situations: a love triangle motivated by love, marriage, desire for money, and the willingness to sacrifice any one for the others. The AT0's calculated for these situational descriptions were also given situational verbal and visual interpretations, and the derived 'surrealistic' image appeared as an icon representing the concept of bigamy, an element not to be found in the original situation examples.

For this model of collective human cognitive processing to be considered valid, it is essential that illustrative examples be found in real societies, in many parts of the world, and at different times in human history. It is the purpose of this paper to demonstrate the existence of such a system in Chinese culture, in the form of the I CHING, a well known system that is part of the main stream history of China-- a system that encodes the philosophy of Taoism & Confucianism, and which has played a significant role in the lives of individuals and governments for millenia.

Before undertaking an analysis of the I CHING as an AT0 calculation system, I present the formal specification of AT0's and the examples just described.

1. An Illustrated AT0 Tutorial

The following is quoted from Klein et al. (1981: 308-309):

ATO's - Appositional Transformation Operators

ATO's relate situational descriptions in the form of feature arrays. A 2-valued version, essentially, is the strong equivalence operator of mathematical logic. If the interpretation of 1 and 0 are reversed, the operator is equivalent to non-carry, binary addition. The ATO is actually an array of bit operators defined as follows:

<u>* a b = c</u>	
0 0	1
0 1	0
1 0	0
1 1	1
..	.

where '.' means 'does not apply,' making this specification 2-valued, with some augmentation.

The operator has the following properties:

<u>*ab = "ATO"</u>		a	↔	b
*ab = *ba	e.g.	110	↔	011
*a(*ab) = b		011	↔	100
*b(*ab) = a		1.1	↔	0.0
		*ab		
		010		
		000		"ATO"
		0.1		

A 3-valued variant is useful for state transitions where events emerge that were not present in the initial state. One can represent this with the 2-valued ATO, but the 3-valued variant is also useful. Again, a reversal of the interpretation of 1 & 0 yields an implementation as non-carry addition.

*	0	1	.	0
0	1	0	.0	.
1	0	1	.0	.
.	0	.	1	0
.0	.	.0	0	.

Examples of ATO's in Analogical Inference

Consider, first, some simple verbal analogies. A feature array referencing 'male,' 'female,' 'young,' 'adult,' 'love,' 'hate,' 'light,' 'dark,' is sufficient to formulate the following analogy:

X = Boy loves light :: Z = Girl hates dark
Y = Woman hates light ?

M F Y A L H Lt Dk where M = male, F = female,
 Y = young, A = adult,
 L = love, H = hate,
 Lt = light, Dk = dark

X = 10101010 :: Z = 01100101 *XY = 00000011
Y = 01010110 ?

? = *Z(*XY) = 10011001 = Man loves dark

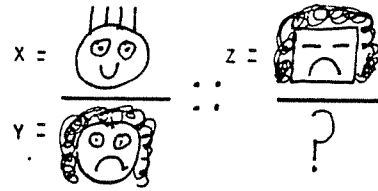
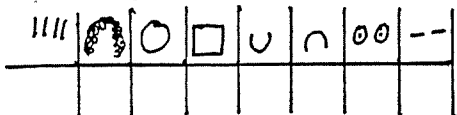
another example:

X = Man hates dark :: Z = Boy hates light
Y = Woman loves light ?

X = 10010101 :: Z = 10100110 *XY = 00110000
Y = 01011010 ?

? = *Z(*XY) = 01101001 = Girl loves dark

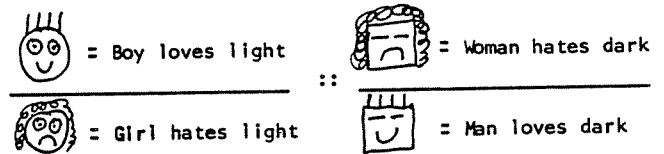
The same method can be applied to visual analogies. For example, if the following set of visual features is used to create a pictorial analogy, the answer can be calculated using ATO's:



X = 10101010 :: Z = 01010101 *XY = 00110011
Y = 01100110 ?
 ? = *Z(*XY) = 10011001 = =

A visual interpretation of *XY might yield .

If we give natural language interpretations to these visual features, such as,



ATO = *XY = = sexless being, both old and young; indifferent to light and dark.

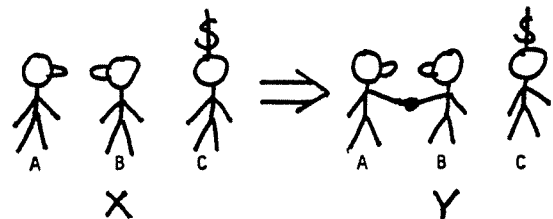
Complex analogies may also be computed, e.g., if (X :: Y) :: (Z :: W) :: (P :: ?) then ? = *P(*XY)(*ZW). Consider a complex example:

X: A loves B, has no \$, and is not married. B loves A, has no \$, and is not married. C loves no one, has \$ and is unmarried.
 Y: A loves B, has no \$, is married to B. B loves A, has no \$, is married to A. C loves no one, has \$ and is unmarried.

Where La = 'loves A,' etc., \$ = 'has money,' and Ma = 'married to A,' etc., the X Y states may be represented as follows:

	La	Lb	Lc	\$	Ma	Mb	Mc
X	A	. 1	0	0	. 0	0	0
	B	1	. 0	0	0	. 0	0
	C	0	0	. 1	0	0	0
Y	A	. 1	0	0	. 1	0	0
	B	1	. 0	0	1	. 0	0
	C	0	0	. 1	0	0	. 0
*XY		. 1	1	. 0	1	. 1	0
		1	. 1	1	0	. 1	
		1	1	. 1	1		

If we depict 'loves' as a nose pointing at the beloved (in between, if two loves), and if a noseless state means 'loves no one,' and if holding hands depicts 'married to,' and if a '\$' indicates, 'has money,'



Z
 A loves no one, has no \$, is married to B. B loves A, has no \$, is married to A. C loves A, has \$, is unmarried.

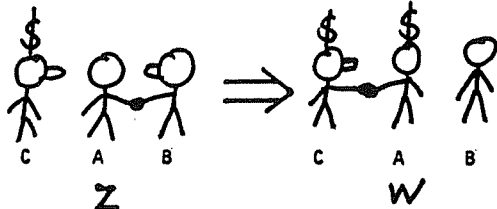
W
 A loves no one, has \$, is married to C. B loves no one, has no \$, and is unmarried. C loves A, has \$ and is married to A.

	La	Lb	Lc	\$	Ma	Mb	Mc
A	. 0	0	0	. 1	0	0	0
B	1	. 0	0	0	1	. 0	0
C	1	0	. 1	0	0	0	.

	La	Lb	Lc	\$	Ma	Mb	Mc
A	. 0	0	0	1	. 0	1	0
B	0	. 0	0	0	0	. 0	0
C	1	0	. 1	1	0	0	.

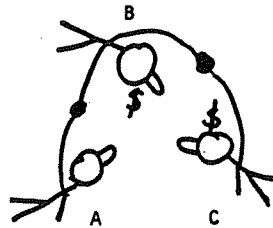
*ZW

. 1	1	0	. 0	0
0	. 1	1	0	. 1
1	1	. 1	0	1



*(XY) (ZW)

. 1	1	0	. 1	0
0	. 1	1	1	. 1
1	1	. 1	0	1



"surrealistic" Interpretation

A loves B & C, has no \$, is married to B. B loves C, has \$, and is married to A & C. C loves A & B, has \$, and is married to B.

If we then postulate a situation P,

	La	Lb	Lc	\$	Ma	Mb	Mc
A	. 1	1	1	. 0	0	0	0
B	1	. 0	0	0	0	. 0	0
C	1	0	. 1	1	0	0	.

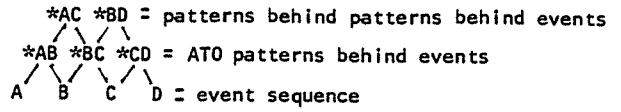
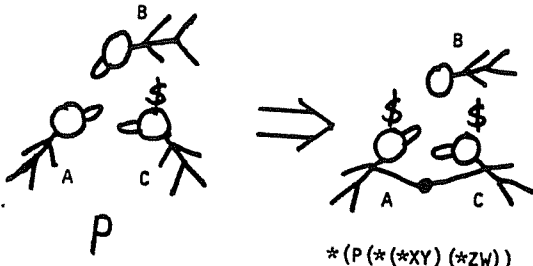
A loves B & C, has no \$, and is unmarried. B loves A, has no \$ and is unmarried. C loves A, has \$ and is unmarried.

we can compute its successor state by analogy with the combined results of $X \Rightarrow Y$ & $Z \Rightarrow W$ by solving $((X :: Y) :: (Z :: W)) :: (P :: ?)$, where ? =

*P(*XY) (*ZW)

	La	Lb	Lc	\$	Ma	Mb	Mc
A	. 1	1	1	. 0	1	0	1
B	0	. 0	0	0	0	. 0	0
C	1	0	. 1	1	0	0	.

A loves B & C, has \$, and is married to C. B loves no one, has no \$, and is unmarried. C loves A, has \$ and is married to A.



If we wish to obtain a state E instead of D, without changing any of the ATO's, we derive, by analogy, a sequence leading to E by replacing A, B, C, respectively, with *A(*DE), *B(*DE), *C(*DE). If we wish to make a plan that specifies more than one goal state in the event sequence, we must alter some ATO's.

We suggest that the meaning of 'culturally defined behavior' is that members of a society plan in a way that minimizes the level and number of ATO's affected. It follows that deviant behavior may be interpreted as behavior that violates acceptable levels and numbers of ATO's. ATO patterns are part of the knowledge acquired by children. We posit that ATO patterns are encoded in multiple mediums of expression, both material and symbolic, and that they are the source of metaphor. It is this encoding that gives form to a culture, and it is this distributed presence in the environment that makes calculation of social behavior computationally feasible for the human mind.

Planning and Deviant Behavior

If a sequence of events, A, B, C, D, occur, then


2. The I CHING as an ATO Calculation System

While members of a Western audience may be familiar with the I CHING as a divination system that is now part of popular Western intellectual culture, they may be unaware of the profound role this book has played in Chinese society for several millenia. Richard Wilhelm, writing in 1923 in his introduction to his German translation of this work stated:

"Indeed, not only the philosophy of China but its science and statecraft as well have never ceased to draw from the spring of wisdom in the I Ching, and it is not surprising that this alone, among all the Confucian classics, escaped the great burning of the books under Ch'in Shih Huang Ti (213 B.C.). Even the commonplaces of everyday life in China are saturated with its influence. In going through the streets of a Chinese city, one will find, here and there at a street corner, a fortune teller sitting behind a neatly covered table, brush and tablet at hand, ready to draw from the ancient book of wisdom pertinent counsel and information on life's minor perplexities. Not only that, but the very signboards adorning the houses--perpendicular wooden panels done in gold on black lacquer--are covered with inscriptions whose flowery language again and again recalls thoughts and quotations from the I Ching. Even the policy makers of so modern a state as Japan, distinguished for their astuteness, do not scorn to refer to it for counsel in difficult situations."

... (I CHING , Wilhelm/Baynes transl., 3rd ed., 1967: xlvii-xlviii)

The characterization of the I CHING that I present here is necessarily limited to features salient to the topic of this paper. The reader is urged to consult the Princeton University Press edition, from which the preceding quotation is taken, for a reputable, scholarly treatment of the subject. I am now going to characterize the I CHING as part of meta-system for generating relational data base structures.

A mechanical method is used to generate a six element, one dimensional array which, in the I CHING, appears as a vertical string of closed and open lines, e.g.  which might be represented horizontally as 101 110. Additional information attached to each element indicates whether its status as a closed or broken line (1 or 0) is stable or unstable. If any unstable elements are indicated, a second, derivative hexagram or array is implied--hence the title, 'Book of Changes'.

The six element array is viewed as being composed of two three - element arrays called 'trigrams.' A significance is attached to whether a trigram is upper or lower in the six element array. The full scheme of interpretation also includes the significance of emergent trigrams in the center of hexagrams.

From the Western point of view, the I CHING seems to function as a divination device: a hexagram is generated by a semi-random procedure, and used as an index to a poetic/mythical, surrealistic image together with a set of commentaries. Unstable elements are given further interpretation, and the derivative hexagram (after the unstable array element transform into their opposites) is also used as an index to the poetic/mythical image & commentaries associated with it.

As with the general class of divination mechanisms, the apparent utility relies on the unconscious ability of the user to project the elements of a specific problem onto an abstract verbal image or text, and to use that original image/text structure as a model or metaphor for the specific problem. The I CHING, however, is part of a system that actually supplies the rules for quantifying its abstract images. This rule system also functions as guide to the computation of metaphor. These rules of quantification consist of equivalence sets of abstract and concrete terms that are markers of classification categories covering the whole range of traditional Chinese world knowledge. The images in the texts, together with their commentaries, encode a structuring of the Chinese universe, originally according to Taoist philosophy, and later in terms of Confucian on the relation of the individual the State, as well. (Systems of classificational equivalence sets are to be found in the history of every society in the world. Western readers need only be reminded of the 'earth, air, water and fire' classification of Alchemy.)

There are eight trigrams, and they are listed with their names and primary associations: (I CHING Wilhelm/Baynes 1967:725-727):

☰	111	☱	110
☰	THE CREATIVE, Heaven	☱	THE GENTLE, Wind
☵	010	☲	101
☵	THE ABYSMAL, Water	☲	THE CLINGING, Fire
☶	100	☷	000
☶	KEEPING STILL, Mountain	☷	THE RECEPTIVE, Earth
☳	001	☱	011
☳	THE AROUSING, Thunder	☱	THE JOYOUS, Lake

The Hexagrams are grouped into 'Houses' of eight members each (ibid):

1. The House of the Creative

1.1	The CREATIVE is Heaven	111 111
1.2	Heaven with Wind is COMING TO MEET	111 110
1.3	Heaven with Mountain is RETREAT	111 100
1.4	Heaven with Earth is STANDSTILL	111 000
1.5	Wind with Earth is CONTEMPLATION	110 000
1.6	Mountain with Earth SPLITTING APART	100 000
1.7	Fire with Earth is PROGRESS	101 000
1.8	Fire with Heaven is POSSESSION IN GREAT MEASURE	101 111

2. The House of the Abysmal

2.1	The ABYSMAL is Water	010 010
2.2	Water with Lake is LIMITATION	010 011
2.3	Water with Thunder is DIFFICULTY AT BEGINNING	010 001
2.4	Water with Fire is AFTER COMPLETION	010 101
2.5	Lake with Fire is REVOLUTION	011 101
2.6	Thunder with Fire is ABUNDANCE	001 101
2.7	Earth with Fire is DARKENING OF THE LIGHT	000 101
2.8	Earth with Water is THE ARMY	000 010

3. The House of Keeping Still

3.1	KEEPING STILL is Mountain	100 100
3.2	Mountain with Fire is GRACE	100 101
3.3	Mountain with Heaven is TAMING POWER OF THE GREAT	100 111
3.4	Mountain with Lake is DECREASE	100 011
3.5	Fire with Lake is OPPOSITION	101 011
3.6	Heaven with Lake is TREADING	111 011
3.7	Wind with Lake is INNER TRUTH	110 011
3.8	Wind with Mountain is DEVELOPMENT	110 100

4. The House of the Arousing

4.1	THE AROUSING is Thunder	001 001
4.2	Thunder with Earth is ENTHUSIASM	001 000
4.3	Thunder with Water is DELIVERANCE	001 010
4.4	Thunder with Wind is DURATION	001 110
4.5	Earth with Wind is PUSHING UPWARD	000 110
4.6	Water with Wind is THE WELL	010 110
4.7	Lake with Wind is PREPONDERANCE OF THE GREAT	011 110
4.8	Lake with Thunder is FOLLOWING	011 001

5. The House of the Gentle

5.1	THE GENTLE is Wind	110 110
5.2	Wind and Heaven is TAMING POWER OF THE SMALL	110 111
5.3	Wind with Fire is THE FAMILY	110 101
5.4	Wind with Thunder is INCREASE	110 001
5.5	Heaven with Thunder is INNOCENCE	111 001
5.6	Fire with Thunder is BITING THROUGH	101 001
5.7	Mountain with Thunder is CORNERS OF THE MOUTH	100 001
5.8	Mountain with Wind is WORK ON WHAT WAS SPOILED	100 110

6. The House of the Clinging

6.1	THE CLINGING is Fire	101 101
6.2	Fire with Mountain is THE WANDERER	101 100
6.3	Fire with Wind is THE CALDRON	101 110
6.4	Fire with Water is BEFORE COMPLETION	101 010
6.5	Mountain with Water is YOUTHFUL FOLLY	100 010
6.6	Wind with Water is DISPERSION	110 010
6.7	Heaven with Water is CONFLICT	111 010
6.8	Heaven with Fire is FELLOWSHIP WITH MEN	111 101

7. The House of the Receptive

7.1	THE RECEPTIVE is Earth	000 000
7.2	Earth with Thunder is RETURN	000 001
7.3	Earth with Lake is APPROACH	000 011
7.4	Earth with Heaven is PEACE	000 111
7.5	Thunder with Heaven is THE POWER OF THE GREAT	001 111
7.6	Lake with Heaven is BREAK-THROUGH	011 111
7.7	Water with Heaven is WAITING	010 111
7.8	Water with Earth is HOLDING TOGETHER	010 000

8. The House of the Joyous

8.1	THE JOYOUS is Lake	011 011
8.2	Lake with Water is OPPRESSION	011 010
8.3	Lake with Earth is GATHERING TOGETHER	011 000
8.4	Lake with Mountain is INFLUENCE	011 100
8.5	Water with Mountain is OBSTRUCTION	010 100
8.6	Earth with Mountain is MODESTY	000 100
8.7	Thunder with Mountain is PREPONDERANCE OF SMALL	001 100
8.8	Thunder with Lake is THE MARRYING MAIDEN	001 011

I have discovered that the arrangement of the Hexagrams in Houses is completely determined by AT0 relations. The structure is a kind of 8 x 8 array, where each element is a Hexagram, and each column is a House. Any House may be transformed into each of the others by taking the successive AT0 * products of its elements with each of the Hexagrams (treated as AT0's) whose upper and

lower trigrams are identical. 4.2 The House of the Abysmal may be transformed

into 6.2 The House of Keeping Still by taking the * product of each of its Hexagram elements and the AT0 Hexagram, 001 001:

* 010 010				100 100
010 011				100 101
010 001				100 111
010 101	,	001 001	=	100 011
011 101				101 011
001 101				111 011
000 101				110 011
000 010				110 100

The House of the Joyous may be transformed into The House of the Arousing by

taking the * product of its hexagram elements and the AT0 Hexagram 101 101:

* 011 011				001 001
011 010				001 000
011 000				001 010
011 100	,	101 101	=	001 110
010 100				000 110
000 100				010 110
001 100				011 110
001 011				011 001

etc..

Furthermore, all Hexagrams occupying the same row position in the House classification can be calculated by the same method used to compute verbal analogies described in Section 1 of this paper. Each trigram component of a Hexagram is associated with a verbal image. If we take the * product of the upper and lower trigrams to generate an AT0, and then take the * product of this AT0 and each of the eight trigrams, we generate eight parallel row entries in the House classification:

$$4.2 = \frac{\text{Thunder}}{\text{Earth}} = \frac{001}{000} . \text{ AT0} = *(\text{Thunder}, \text{Earth}) = *(001,000) = 110$$

$$\frac{\text{Thunder}}{\text{Earth}} :: \frac{\text{Fire}}{?} = \frac{001}{000} :: \frac{101}{?} ; \quad ? = *(\text{Fire}, *(\text{Thunder}, \text{Earth})) = *(\text{Fire}, 110) \\ = *(101, 110) = 100.$$

$$\text{But, } 100 = \text{Mountain, therefore, } \frac{\text{Thunder}}{\text{Earth}} :: \frac{\text{Fire}}{\text{Mountain}} = 4.2 :: 6.2$$

$$\text{Similarly, } \frac{\text{Thunder}}{\text{Earth}} :: \frac{\text{Lake}}{?} = \frac{001}{000} :: \frac{011}{?}$$

$$? = *(\text{Lake}, *(\text{Thunder}, \text{Earth})) = *(011, 110) = 010 = \text{Water}$$

$$\text{Therefore, } \frac{\text{Thunder}}{\text{Earth}} :: \frac{\text{Lake}}{\text{Water}} = 4.2 :: 8.2$$

In a similar fashion, one may derive 3.2 by computing $*(\text{Mountain}, 110) = \text{Fire}$;
 1.2 by $*(\text{Heaven}, 110) = \text{Wind}$; 2.2 by $*(\text{Water}, 110) = \text{Lake}$; 5.2 by $*(\text{Wind}, 110) = \text{Heaven}$;
 7.2 by $*(\text{Earth}, 110) = \text{Thunder}$. The other row equivalences are computed in exactly the same way.

The House classification reflects a system of verbal analogies which are defined by 1st-level AT0 relations. Each of the verbal images is also the marker of one or more classes consisting of such elements as a corresponding color, season, direction, element, kinship term, climate, mountain, planet, sound, musical note, virtue, emotion, animal, viscus, body orifice, flavor, odor, emperor, etc. An I CHING commentary explains the motive (I CHING Legge 1899, Appendix III, Sec. II, Ch. X, 63):

"The Sage was able to survey all the complex phenomena under the sky. He then considered in his mind how they could be figured, and by means of the diagrams represented their material forms and their character. Hence these diagrams are denominated semblances."

and (Ibid, Sec. I, Ch. VIII, 38)

"...the names of the diagrams and lines are but small matters, but the classes of things comprehended under them are large."

The use of the I CHING as divination device usually yields the generation of two Hexagrams. The first is derived by a semi-random method that may include the additional information that certain of the closed or broken lines (1 or 0) are unstable, and in a state of transformation into their opposites. This uniquely determines a second Hexagram which is viewed as a transform of the first. This correspondence between the two Hexagrams now determines a new system of verbal analogies which may differ from that implied by the basic 'House' classification

described earlier. Suppose that a divination attempt yields the Hexagram 001 000 (4.2) and the transform partner 101 111 (1.8). The AT0 that relates these is $*(4.2, 1.8) = *(001\ 000, 101\ 111) = 011\ 000$. The implied verbal analogy is:

$$\begin{array}{l} \text{Thunder} \\ \text{Earth} \end{array} :: \begin{array}{l} \text{Fire} \\ \text{Heaven} \end{array} . \quad \text{The AT0} = *(\text{Thunder Earth, Fire Heaven}) \\ = *(001\ 000 , 101\ 111) = 011\ 000$$

But this AT0 may be used, systematically, to obtain transforms of the Houses in the original scheme. The result is a new House classification scheme that is related to the original by the analogy 4.2 :: 1.8, or $\frac{\text{Thunder}}{\text{Earth}} :: \frac{\text{Fire}}{\text{Heaven}}$. To illustrate this consider the result of taking the * product of this AT0 and the second element of each of the original Houses:

$$\begin{array}{l} * \quad (1.2) \ 111\ 110 \\ \quad (2.2) \ 010\ 011 \\ \quad (3.2) \ 100\ 101 \\ \quad (4.2) \ 001\ 000 \\ \quad (5.2) \ 110\ 111 \\ \quad (6.2) \ 101\ 100 \\ \quad (7.2) \ 000\ 001 \\ \quad (8.2) \ 011\ 010 \end{array} , \quad 011\ 000 \quad = \quad \begin{array}{l} (4.8) \ 011\ 001 \\ (3.8) \ 110\ 100 \\ (2.8) \ 000\ 010 \\ (1.8) \ 101\ 111 \\ (7.8) \ 010\ 000 \\ (8.8) \ 001\ 001 \\ (5.8) \ 100\ 110 \\ (6.8) \ 111\ 101 \end{array}$$

and doing the same for the seventh element of each of the original Houses yields:

$$\begin{array}{l} * \quad (1.7) \ 101\ 000 \\ \quad (2.7) \ 000\ 101 \\ \quad (3.7) \ 110\ 011 \\ \quad (4.7) \ 011\ 110 \\ \quad (5.7) \ 100\ 001 \\ \quad (6.7) \ 111\ 010 \\ \quad (7.7) \ 010\ 111 \\ \quad (8.7) \ 001\ 100 \end{array} , \quad 011\ 000 \quad = \quad \begin{array}{l} (7.5) \ 001\ 111 \\ (6.5) \ 100\ 010 \\ (8.5) \ 010\ 100 \\ (5.5) \ 111\ 001 \\ (4.5) \ 000\ 110 \\ (2.5) \ 011\ 101 \\ (1.5) \ 110\ 000 \\ (3.5) \ 101\ 011 \end{array}$$

etc.

Thus, the original Hexagram transformation, 4.2 (001 000) to 1.8 (101 111), with its implied verbal analogy, Thunder : Earth :: Fire : Heaven, can actually generate a whole new system of verbal analogies, quite different from that implied by the I CHING's original classification into Houses.

3. Discussion

I have demonstrated that the original arrangement of the Hexagrams in Houses, described in the I CHING, is, without question, based on an ATO logic.

It is my personal extrapolation that the determination of a Hexagram and its transform, as part of a divination process, actually implies a new classification of Hexagrams, with a new system of verbal image analogies. Yet, this extrapolation seems quite justified by commentaries on the role and function of the I CHING (Wilhelm/Baynes 1967:263):

"The hexagrams, consisting of six lines each, are, so to speak, representations of actual conditions in the world, and of the combinations of the light-giving, heavenly power and the dark, earthly power that occur in these situations. Within the hexagrams, however, it is always possible for the individual lines to change and regroup themselves; just as world situation continually change and reconstitute themselves, so out of each hexagram there arises a new one."

...

"The hexagrams give complete images of conditions and relationships existing in the world; the individual lines treat particular situations as they change within these general conditions."

A justification for taking the original grouping of Hexagrams in Houses as basic, and for taking the semi-randomly determined divination Hexagram as an index into this structure can be found in the following (Wilhelm/Baynes 1967:281):

"Nonchange is the background, as it were, against which change is made possible. For in regard to any change there must be some fixed point to which the change can be referred; otherwise there can be no definite order and everything is dissolved in chaotic movement. This point of reference must be established, and this always requires a choice and a decision. It makes possible a system of co-ordinates into which everything else can be fitted. Consequently at the beginning of the world, as at the beginning of thought, there is the decision, the fixing of the point of reference. Theoretically any point of reference is possible, but experience teaches that at the dawn of consciousness one stands

already enclosed within definite, prepotent systems of relationships. The problem then is to choose one's point of reference so that it coincides with the point of reference for cosmic event. For only then can the world created by one's decision escape being dashed to pieces against prepotent systems of relationships with which it would otherwise come into conflict. Obviously the premise for such a decision is the belief that in the last analysis the world is a system of homogeneous relationships--that it is a cosmos, not a chaos. This belief is the foundation of Chinese philosophy, as of all philosophy. The ultimate reference for all that changes is the nonchanging."

The role of ATO's in the I CHING is clear. As postulated in Section I of this paper, ATO's are seen to function both as high-level state descriptions, and as operators. It is for the human user to quantify particular, abstractly described, world-states. But the I CHING, with the systems of classification of world phenomena contained in Chinese philosophy, actually provides a guide for quantifying the state descriptions.

The I CHING is a consciously developed product of millenia of the functioning of Chinese social life. Similar systems for categorizing the universe and for calculating relationships are extant or in the history of virtually all human societies. The fundamental contemporary work describing their nature and function is Claude Lévi-Strauss' La Pensée sauvage (The Savage Mind) (1962). The I CHING appears to be a highly developed example of what Lévi-Strauss describes as the Totemic Operator (ibid) which is equivalent to a specification of the ATO concept. Articulated divination schemes are found in many societies; Western civilization is not exempt. Consciously articulated analogical calculating systems can be found in a line of history that includes Pythagoras, Hermes Trismegistus, Alchemy, Kabbalah and the Ars Magna of Ramon Lull. The influence of such work persisted through the Renaissance, and the latter is in the acknowledged intellectual background of Leibnitz and Descartes.

I have posited that ATO systems are unconscious means by which humans in social groups calculate behavior by analogy. To better understand this concept,

assume that the I CHING is part of an internalized, cognitive system that is driven, not by the stimulus of a randomly calculated Hexagram, but by a sample of reality in the form of a situation description. Given such an input, the system will automatically redefine its analogical relations, globally. This is the basis for calculation of behavior by analogy, and the basis for the perception and use of metaphor.

For the ATO model to be accepted, one would expect evidence from split-brain research; psychology; functional computer modelling; and, in particular, cross-cultural evidence, both contemporary and historical. Hopefully, the analysis of the I CHING presented here, representing the last category, will serve to stimulate the search for evidence in all of the areas.

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