Games of Chance: Explorations into our Animal Selves

Siddharth Ramakrishnan[1] and Victoria Vesna[2]

[1]Neuroscience Program, Department of Biology, University of Puget Sound,

Tacoma, WA -98416, sramakrishnan@pugetsound.edu

[2] Design Media Arts, Art | Sci Center, University of California Los Angeles,

Los Angeles, CA – 90095, vesna@arts.ucla.edu

Abstract

The authors come together from very different disciplines – art and neuroscience – in order to create an interactive work that engages the audience in a way that takes them out of the anthropocentric point of view. With this collaborative project, we wish to break this "human" barrier and allow an exploration and identification of the diverse world of the animals around us. *The Hox Zodiac* allows the human-audience to experience the shared history and potential of genetic diversity among animals. We introduce the idea of the Hox gene as a binding element and employ the Chinese animal zodiac and dinner table as the structure / space for discussion, allowing the format to build based on the audience interaction. In neuroscience this is the emergent property of network connections, where a simple array of neurons can give rise to complex behaviors through interactions and adaptations.

Responding to the emergent nature of the game-like environment, we turn to the ancient book of Change, the I Ching, and the related work of John Cage.

Similarly to Cage's ideas of chance and indeterminacy, we look to the eastern ancient philosophies along with the scientific research, seeking the balance between rational and irrational, conscious and unconscious – in relation to our interconnectivity with the animal kingdom. The essay describes the research process and variations that emerged with audience participation and interaction.

KEYWORDS: Hox gene, Chinese zodiac, I Ching, Neuroscience and art, Animal Human

Introduction

> "The eight trigrams are symbols standing for changing transitional states; they are images that are constantly undergoing change. Attention stands not on things in their state of being – as is chiefly the case in the Occident – but upon their movementsin change. The eight trigrams therefore are not representations of things as such but of their tendencies in movement"
>
> Richard Wilhelm, Introduction, in Wilhelm, trans. I Ching. (Princeton, 1950)

Our perception and experience of the world around us is limited by an anthropocentric viewpoint – some of it is a physical limitation of our senses, but it is also because we forget that as animals we share a common inheritance both genetically and ecologically with the myriad of species around us. In this essay we detail a few explorations that we have embarked on to break down this anthropocentric filter that limits our World view.

While we humans tend to place ourselves on a higher plane than the other animals around us, we cannot escape the fact that we share both evolutionary and genetic history with other organisms, and currently co-exist (albeit tenuously) within shared ecosystems and biomes. Animals feature prominently in our stories

and myths (from origin of the world stories to incarnations to tales of banishments), are commonly used as comparisons in linguistic usage (sly as a fox; strong as an ox) and within some societies have an indelible link with the human experience. Domestication of animals has also led to the success of the human species, transforming us from a hunter-gatherer to an agrarian society. The role of animals as pets and sources of emotional comfort has also emerged, leading not only to an increased awareness of animal needs but also to a co-evolution between humans and animals. Further, quality of human life has improved tremendously over the last two centuries primarily because of the role animals play in laboratory science, medical research and drug testing. This is about to explode further in the near future as technology advances and we are on the cusp of creating hybrid beings (species enhanced with capabilities of others) and Xeno-harvesting (harvesting human organs grown within “donor species”)[Agnew].

With all the entwining of lives of humans and animals, in terms of shared spaces, genetic material and soon literally, we do not often as a society pause to consider how connected we are to the organisms around us. Our education strives to make the distinction ensuring that humans are considered different and not part of the animal “whole”. Primal instincts such as sexual lust and fear are dismissed as animalistic and beneath our more evolved beings. Even life scientists who in the past began their training broadly as “Naturalists” and “Zoologists” are now immediately thrown into studying humanistic models of diseases, with no foundation of placing humans in the context of the animal

kingdom.

The Hox gene and the Book of Change come together in a dinner table game

> The matter of interest seems to be the configuration formed by chance events in the moment of observation, and not at all the hypothetical reasons that seeimgly account for the coincidence"
>
> CG Jung, Foreward, in Wilhelm trans. I Ching. Pg. xxiii

We come from two different worlds -- (media) arts and (neuro)science and do not identify ourselves with the gaming world. Indeed, we hardly participate or play games but by allowing the audience to take the helm in the project, it took on a game mode very quickly. At one point in the development of this topic and the parallel search for best interfaces, we even hired a game designer but found that the established rules and expectations of the gaming world do not apply well to our explorations. Indeed, after experimenting with various formats and strategies, we made a conscious decision to not include any technology but focus on creating the context, the circumstance that makes the table into one giant petri dish. The "play" that we felt was much more appropriate was based on the I Ching, the Book of Change and our approach was closer to that of conceptual artists who applied these "rules" such as John Cage. It should be noted that Cage's work with the idea of chance is frequently misunderstood – he in fact understood that there is no such thing, that we experience different forms of order in relation to our perception based on our societal barriers. The idea of chance was used more as a framework to point out the various different possibilities of interpretation.

With our collaborative projects, we wish to break this "human" barrier and allow an exploration into the diverse world of the animals around us. *The Hox Zodiac* allows the human-audience to experience the shared history and potential of genetic diversity among animals that very much includes us, the human animal. We explore with an audience the rich differences amongst the animals around us, while iterating the shared themes and common constructs that underlie the genetic basis of *all* body plans, humans included. These experiences are ongoing collaborations between an artist and a scientist that are modified based on play testing and audience feedback from exhibitions around the world. We will detail the origins of our collaborations and how over time they have evolved into their current game versions, and our future visions for the project.

The Hox Zodiac: Genetic Games of Chance

> "It necessarily follows that chance alone is at the source of every innovation, and of all creation in the biosphere. Pure chance, absolutely free but blind, at the very root of the stupendous edifice of evolution: this central concept of modern biology is no longer one among many other possible or even conceivable hypotheses. It is today the sole conceivable hypothesis, the only one that squares with observed and tested fact. And nothing warrants the supposition - or the hope - that on this score our position is ever likely to be revised. There is no scientific concept, in any of the sciences, more destructive of anthropocentrism than this one."
>
> — Jacques Monod, *Chance and Necessity*

Genetic information is the foundation of all living creatures we see around us. The DNA sequences are used to codify numerous functions – from keeping

the cells alive to helping them survive. The basic genetic code comprises of four nucleotides A, T, G and C which serves as a four letter code. Three nucleotides in sequence (ex: ATG, UUU, GGG) are the code for an amino acid, thereby allowing the translation of the genetic sequences into functional proteins. Thus 64 nucleotide triplets (4^3) are used to translate into the 26 letter alphabet of amino acids [Pierce, 2013]. It is of note that the I Ching also has 64 different hexagrams within its coda. A few philosophers and mathematicians have compared the I Ching to the DNA language, and researched how the 64-bit code of the DNA and I-Ching match up [Shoenberger 1992]. Further, the I Ching is based on the principle of the yin and the yang – the combination of male and female energies, the epitome of sexual reproduction, which forms the basis of heredity and variation in genetics [Wilhelm and Baynes 1967]. Lao Tze wrote in the Tao Te Ching that the Tao gave birth to one, the one to two, the two to three, and the three gave birth to all things. This could be just as easily applied as a description of the 64 codons of genetics.

Genetic information, despite the basic simplicity of its nucleotide bases, has the ability to code for basic cellular and organismal functions – such as breathing, using sugars to create energy, reproduction etc. But aside from such "housekeeping" functions that keep an organism alive, the DNA also codes for form and function – somewhat surprising if you look at the varieties of shapes and sizes of organisms around us. Though the world is composed of creatures of myriad varieties, there is an underlying commonality amongst all of them that define certain body structures that determine the timing of their development and

where they are located in the growing embryo. This specific set of information is coded in a set of genes called the Hox genes [Carroll 2004].

The Homeobox (hox) genes essentially define body regions in all animals including humans – responsible for determining two arms, two legs, one nose and so on. This gene is shared by all living beings – from the snail to the elephant to humans. Despite all the differences our human form is as similar to that of a goat or a tiger – the coded entities making our foot, also codes for a pig hoof or a chicken leg, and a mouse eye is similar to the snakes and to us [Carroll 2004]. The Hox genes are arranged in a specific order in animal chromosomes – with the order of arrangement corresponding to the body alignment from head to the torso and limbs, abdomen and the hind parts. This parallel arrangement of the genes to the body structures is termed as collinearity, and is also conserved across evolution. While in mammals, there are multiple copies of Hox genes, to create a cushion of redundancy, the underlying set of 8 Hox genes and their collinear arrangement with the body remains the same – highlighting the fact that this common principle underlying body plans has been conserved across species through evolution [Carroll 2004].

> “Chance is the only true source of novelty.”
> Life Itself. Crick, F. The Origin and Nature, pg 58, (1982)

With the current trends in technology, we are able to modify and target genes to alter how the information is coded, fast moving towards engineered organisms and humans. Laboratory manipulation of Hox genes is common in animals such as flies and tadpoles. It is commonly used as a means to

understand developmental programming and the timing of development of different body structures. When does the brain develop? What structures of the brain develop first? What are the origins of the limbs? Why does the snake have a long torso and not a turtle? Why do octopuses and snails look so different even when they are molluscs? What is the timing of development of the heart? How are changes in the uterine wall during menses related to genes? How do genes play a role in transformation during puberty? These and many more are questions that can be directly answered by studying Hox genes and their mutations (Figure 1).

Figure 1 – Hox gene mutated fruit fly with legs growing on its head

Now it is fair game to modify a fly to have legs on its head, or grow ears on mice – thereby creating creature blends where the demarcation between human and animal will soon be hazy. What is even more surprising is that hybrid creatures have been a constant feature in our myths – from the winged Pegasus to the snake haired medusa to the animalistic Egyptian deities to the many-armed Indian gods. Iconography and detailed description of these mythic creatures have prevailed centuries of human civilization. Hybrid creatures have

also long served as themes in speculative fiction – from insect headed humanoids to vampiric predators to super-humans with animal DNA in them. These are interesting times that we live in where myth and speculation are fast becoming reality – which raises the question of how much myth is based on history, and how much speculation is based on foresight.

Genetic information is the ultimate game of chance – a success of evolution that is based on heritability, mutations and variations that promise of survival, species propagation and enhancement. With the advent of technologies, more accessible and readily available to a wider variety of people, we are now at the cusp of playing and toying with this game of chance. The Hox Zodiac game has been created to bring forth to the consciousness of the audience the commonality that we share with the animals around us by expanding the idea of their zodiac animal sign.

Hox Zodiac 1.0: Origins - Shadow Hox, 2009

When the artist (VV) and the scientist (SR) first met, the concept of Hox genes as the common blueprint of all animal body plans came up. The idea that despite such different variety in body types and limb patterns, there is an underlying commonality in the basic plan, felt important – a nuance that everyone should be aware of, which would hopefully allow people to relate to the world around them in a more empathetic way. This formed the crux of our collaboration. The intersection of Art-Science partnerships is not easy. There is a constant struggle between the scientific principle and the artistic interpretation.

While the design and the representation by the artist provide the aesthetics and accessibility to the work, without consideration of the underlying scientific principle, the work misses an important dimension.. The collaborative process between the artist and the scientist is one with emergent properties, with the final result (at least in our case) being an ongoing series of changes to the initial conceit, in order to achieve the best audience immersion. The evolution of our audience driven games is a direct evidence of our continued evolution as an artist and a scientist, and the amalgamation of our collaborations.

The first iteration of the Hox project involved capturing shadows of the audience in front of a screen and then projecting different limbs of animals onto them (Figure 2). Depending on how near or close the participant was, they acquired the limbs of a horse, wings of a cock or the body of an elephant. Body parts could be interchanged, while preserving the basic body plan. However the electronic nature of the medium felt remote and the message of common genetics was not conveyed effectively. Further, we felt that the interface was not allowing a longer engagement or interaction with others, which we felt necessary for the layered meanings to be absorbed and appreciated. This led us to reimagine the piece to not involve computer interface but be purposely :unplugged". We considered using the roulette as an interface and noticed that during our discussions we often sat around it on the table, which made us think of it more as a place for discourse about the issues we were trying to bring to the forefront.

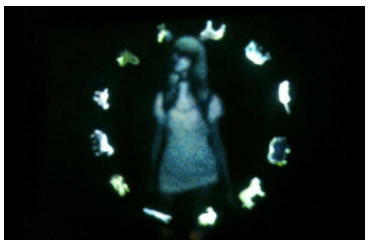

Figure 2: Shadow Hox

Hox Zodiac 2.0 at Microwave Hong Kong 2011

When invited to present the Hox Zodiac project in Hong Kong for the Microwave New Media festival, we decided to revisit the project from a different angle. One of the issues we were confronted with is that the hox gene is shared by all living creatures and we were not sure how to narrow it down to a number that made sense. Thinking about presenting this project in China gave VV the idea to use the Chinese zodiac as a framework – it immediately offered the 12 different animals representing the morphological diversity that we encounter in the animal kingdom, the zodiac offered a rich template to work on. We liked the idea that people already had a default identification with the assigned animal based on their birth and that is came from the Chinese culture that is currently becoming more and more influential globally. Further, our observations revealed that six of these zodiac animals are commonly used in scientific labs (rat, pig, sheep, dog, rabbit and monkey), while five others are wild (tiger, bull, snake, horse, rooster, with the dragon being the mythical creature from the past or the mutant hybrid of the future. The Zodiac allows people to relate to each other on various levels – the fact of having a birthdate grouping you with certain people, and the fact of being human with form also grouping you with all forms of life. For instance, zodiac signs are interpreted in relation to career, relationships, health

and wealth. Animal personalities are assigned to humans based on these signs as well - making the zodiac an excellent anthropocentric link for us to work with when talking about common genetic blueprints encoded within all living creatures. With the "Hox Zodiac" we wished to bring forth to the consciousness of the audience the commonality that we share with animals by expanding the idea of their Chinese zodiac sign. Westerners not familiar with the zodiac discovered a new animal they had a relationship with and those part of or familiar with Chinese or Asian culture were confronted with a new point of view.

Thus "Hox Zodiac" took form as a dinner table for twelve that would seat one person belonging to each zodiac sign. At the center was a lazy susan (that could be rotated by the audience), with a clear mannequin representing the body as a vessel, containing an aqueous solution. Four bottles filled with different colored liquids dripped into the mannequin, representing the four nucleotides that make up our genetic code A, T, G and C. Audience manipulation of the lazy susan would alter the way the colour dripped into the "body" - an analogy to the genetic manipulation that is currently happening in labs around the world [figure 3 - Schematic of hox table]

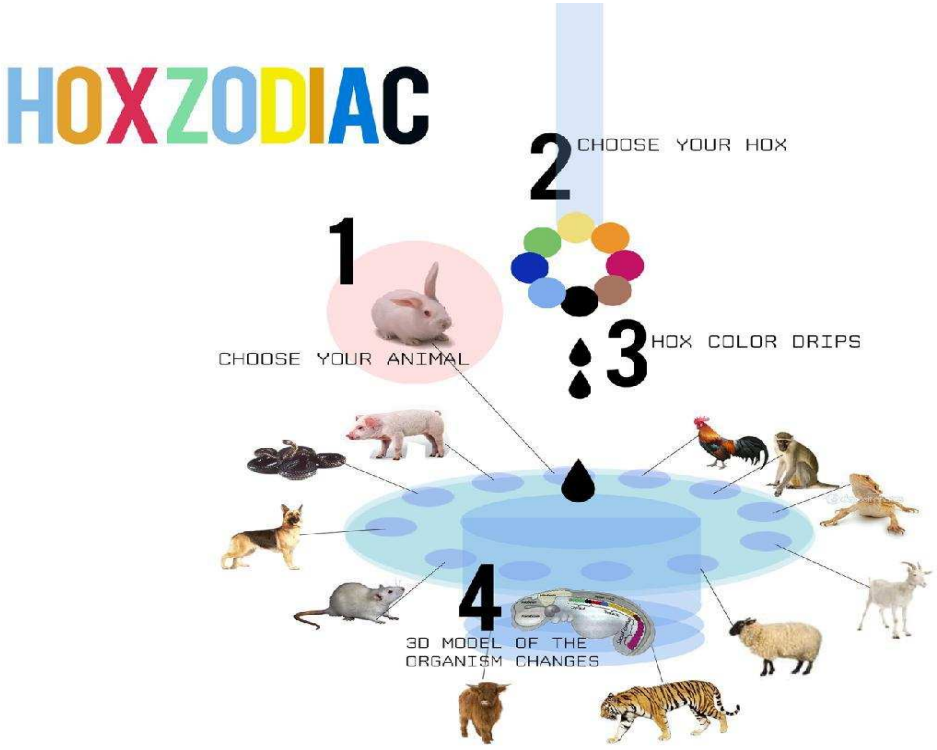

Figure 3: Schematic of the Hox Zodiac table

Even as the installation was progressing, the place began to reshape some of our ideas. While SR was on location in Hong Kong, he was looking for materials while jet-lagged, and encountered a shop where an herbalist highlighted the connection between traditional Chinese herbs and the zodiac. Much of this information was gleaned by pointing, interpretation and shaking of heads on both sides. For example the Tiger rules the Lung, while the Monkey is linked to the Bladder [Table 1]. We also discovered that Chinese herbs were ingested that could cure ailments associated with each of these body parts - the snake governs the spleen which is treated with radish seeds and the ox rules the liver treated with peppermint. Given the fact that we were creating a dinner table,

with guests who were linked to the zodiac signs, we decided to incorporate these edible herbs into the exhibit [Figure 4].

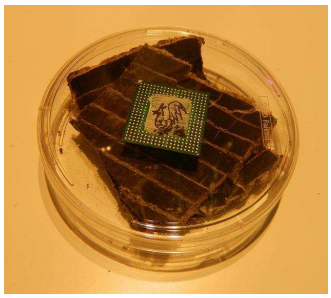

Figure 4: Herb associated with the Rooster

The Hox Zodiac dinner was set, and people from the audience who belonged to a specific zodiac sign were seated at the table. The audience assumed the role of their given animal signs, and began a conversation that discussed the industrialization of food, laboratory testing, sacrifice and animal/human relationships in our contemporary society as well as tapping into the ancient philosophies around this subject. Fear of mutation and the laboratory manipulation of genetics were being raised as well. The audience was encouraged to partake and taste from the herbal specimens at their plates, with frequent cross-pollination occurring between participants. All the while, the body at the center was rotated and moved, creating a dizzying alteration in the coloured ‘nucleotides’ that dripped in the center [Figure 5].

Figure 5: Hox Zodiac 2.0 installation and interaction

"Hox Zodiac" participants related to each other on various levels as humans sharing similar body designs, assuming anim4al persona and shapes, and as creators of mutant creatures, thereby playing the role of scientists in labs. Experts emerged from the audience themselves, and within moments a dinner where information was being shared, became one of learning from the expert at the table.

While the audience engaged in the Hox Zodiac and the reception was tremendous, one main drawback was that the concept of modified Hox Genes resulting in mutated body-plans was not emphasized. Audience participants who were more interested in the scientific basis of the project could have explored further via our website, but we were concerned that some of the take-away message was being lost in the installation. We also observed that participants wanted to have food at the dinner table and had to spend some time considering

how we could incorporate that into the next version.

Hox Zodiac 3.0: Dinner at MOCA Taipei

The success of the Hox Zodiac dinner at Microwave Festival 2011, led to an invitation to showcase the piece at the *Post-Humanist Desire* Exhibition at MOCA Taipei in 2013 [REF]. We continued to push our boundaries in making the Hox Zodiac more interactive, and create a dinner table game that would evoke different conversations.

The I-Ching re-emerged as a tool to play the genetic game of chance. The representation of the lines in the I-Ching cards resemble the cartoons of chromosomes in cell biology textbooks – with the broken lines in the I-Ching appearing similar to the process of crossing over and genetic information transfer during meiosis in our cells. The process of crossing over in the chromosomes where genetic material is exchanged is how we get variation in our genetics and how we appear as individuals and not identical clones of our parents. This basis of heredity and variation is once again a universal principle among all creatures.

Further, we discovered that certain I Ching cards represent specific signs of the Chinese zodiac [Figure 6], and also have been linked to the coding sequences underlying amino acids [Figure 7].

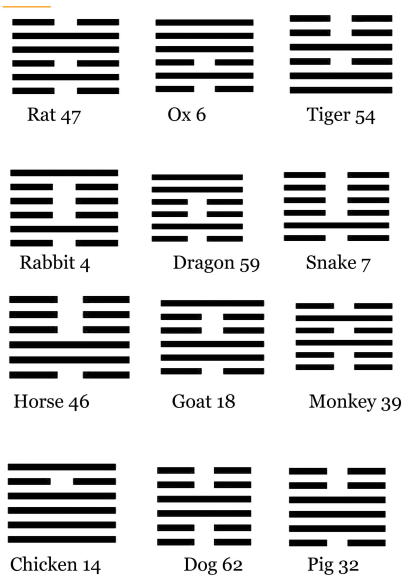

Figure 6: I-Ching Hexagrams representing Chinese Zodiac signs

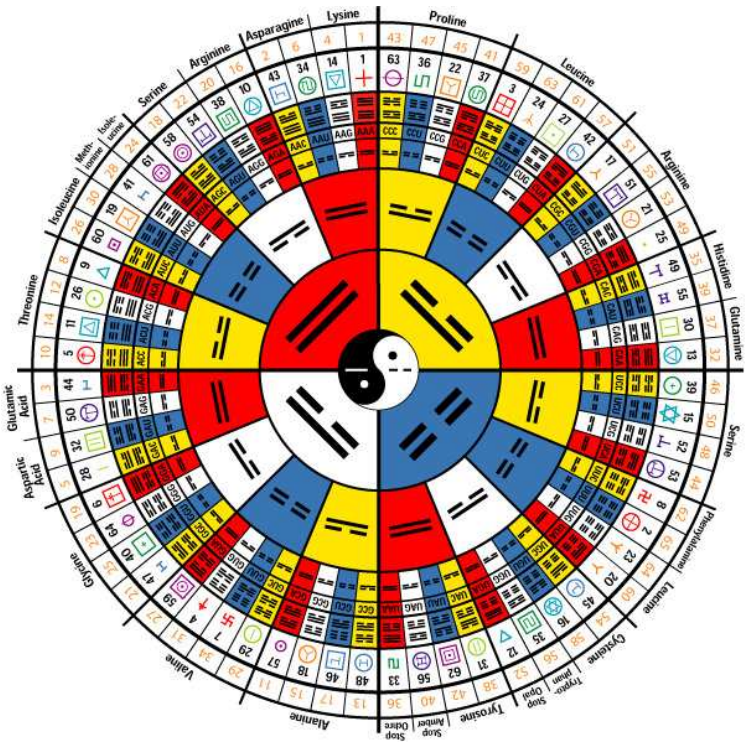

Figure 7: I-Ching representation of amino acids

Other patterns began to emerge – the Hox genes are activated in a time dependent manner, if things go wrong the head would develop later than the foot,

leading to many developmental defects. The Chinese Zodiac itself is represented as a clock, with the rat beginning at 11pm -1am moving forward with the ox (1-3pm) and so on all the way to the pig (9-11pm). Our goal was to provide a game framework that could appears highly simplistic, but has layers of details underneath for the interested participant.

The Hox Metamorphosis Zodiac presented at MOCA Taipei was set up as a circular table with a large translucent egg in the middle. This represented the proto-embryo, the potential of what could be once the genes play into its development. Twelve lab coats with the symbols of the Chinese Zodiac painted on them were lined up against the wall. The table was set for twelve – one for each animal of the zodiac. Audience participants belonging to each zodiac sign were invited to sit at the table. Once the table was full, we began the game (Figure 8).

At each place setting was present a petri dish containing the Chinese herbs associated with the zodiac animal (Table 1), a repository for the DNA of

the participant (either hair or saliva), dining tools in the form of forceps, a little repository of little known facts about the animal and finally a drawing book. A set of cards with 12 symbols from the I Ching corresponding to each animal (Figure 9) and a “mutant” human card was also placed at the table.

Figure 9- The I Ching Zodiac cards

The rules of the game were initially set, but were flexible based on the audience participation and level of complexity. Every animal at the table started by placing their DNA in the repository – this was their essential commitment to the game. Then all the animals begin by drawing their own head (rat with a rat, ox with an ox and so on). The Rat always begins (as the head of the clock). It begins by reading a fact about the animal – these ranged from medical use of animals, animal use in cooking, or in herbs or any form of biological role. Then the rat draws from the deck of cards. This new animal is now part of the rat mutant, and will be drawn into the books. Play then shifts to the animal on the right.

Within a few iterations, we began to get a whole new combination of mutant creatures – monkeys with horse limbs, snakes with rabbit ears and a mish mash of different creatures. Artists began to emerge among the participants, many of whom informed us that they had not engaged in such

creative exercises in decades. They ranged from young children to older experienced scientists, who all explored the role of the mutants, learnt from the factoids and the herbs, and created hybrid creatures in the process (Figure 10).

Figure 10: Mutant hybrid animals

Current Development

> "what is it that's not art & not science? I asked, & I finally got the answer, discourse, which stands in both, and behind both. It is our discussed world, so brought into being. Robert Kelly, 1974

At the time of writing this essay, we are preparing our final version that is going to be developed over the year and available for a larger public by 2016. The idea is to create the Hox Zodiac in a Box that will have all the elements for anyone to set up a "dinner table". The contents will be: table cloth with zodiac signs, plates, petri dishes and a set of books that give information about individual signs: general zodiac meanings, evolutionary, how it is used in science laboratories, the benefits and abuse and as food. In public presentations, we

supply lab coats with the zodiac signs and empty lab note books that audience fill in with their findings. The basic set-up is the following:

People sit down at their animal sign as assigned by the Chinese Zodiac. The first 30 minutes is spent on learning about themselves and making notes on thoughts, responses and questions. For appetizer, basic grains dishes and drinks are offered, ideally from local origins and a menu with the various animals is passed around. Herbs associated with your sign are on your plate already, in the petri dish and description of the organ.

Appetizer: The first question asked is – would you eat yourself, ie. the animal that you are represented by? If not, which animal would you eat? You have to survive so a choice is necessary and by picking one, you are starting to evolve your being to a new variation. Either remain within your self or start a dialogue with the animal you need to continue on. You write down your recipe and / or draw what you are creating by your choices.

Main dish: Choose something related to scientific use of your animal if one of the lab creatures and / or find out which animal is used in relation to your organ. Write out your dish based on this.

Desert: If you wanted to create a hybrid of yourself, which of the animals would you use? What mythical/fantastic powers will you gain by this? What would this mythical beast taste like, smell like, feel like, see like?. Write your recipe for this.

Drink: By drinking the essence of the animal, you change the organs of your body. What aspect of your body do you want altered? What do you feel about this? Given such a miracle essence, would you take it?

Table 1: Herbs associated with each body part governed by an animal of the Chinese Zodiac

Animal	Body Part	Herbs
Tiger	Lung	white mustard seed, genkwa flower, agastache, ephedra, hyacinth bletilla, plantain seed, lily bulb, mulberry leaf, ginseng, glehnia root, magnolia bark, dried ginger, lepidium seed, Chinese yam, tangerine peel, cinnamon twig, chrysanthemum, radish seed, astragalus root, scrophularia root, peach kernel, honeysuckle flower, polygala root, macrostem onion, forsythia fruit, dangshen, schizonepeta, black plum, ophiopogon root, gypsum, wolfberry bark, anemarrhenia rhizome, wolfberry fruit, isatis leaf, Cape jasmine fruit, dahurian angelica root, scutellaria root, inula flower, perilla seed, platycodon root, pinellia tuber, trichosanthes fruit, motherwort, kansui root, Licorice root.
Rabbit	Large Intestine	kansui root, rhubarb, magnolia bark, macrostem onion, areca seed, pumpkin seed, genkwa flower, inula flower, immature bitter orange, hemp seed, coptis root, peach kernel, phellodendron bark, arborvitae seed, honeysuckle flower, cistanche, pulsatilla root, black plum, triocanthes fruit, perilla seed, bush-cherry seed
Dragon	Stomach	scutellaria root, inula flower, honeysuckle flower, pinellia tuber, hemp seed, dahurian angelica root, atractylodes rhizome, isatis leaf, scrophularia root, gypsum, white atractylodes rhizome, Cape jasmine fruit, dried ginger, Agastache, amomum fruit, oriental wormwood, evodia fruit, ophiopogon root, immature bitter orange, magnolia bark, germinated barley, radish seed, quisqualis fruit, areca seed, pumpkin seed, glehnia root, hyacinth bletilla, notoginseng, grass-leaved sweetflag rhizome, liquorice, dendrobium stem
Snake	Spleen	pinellia tuber, radish seed, ledebouriella root, atractylodes rhizome, amomum fruit, poria, pueraria root, psoralea fruit, germinated barley, cordydalis tuber, curcuma root, ginseng, dangshen, astragalus root, white atractylodes rhizome, inula flower, agastache, oriental wormwood, quisqualis fruit, tangerine peel, immature bitter orange, evodia fruit, hawthorn, cinnamon bark, Chinese yam, black plum, liquorice, Chinese angelica root, white peony root, bitter cardamom, lotus seed.
Horse	Heart	isatis leaf, isatis root, prepared rehmannia root, moutan bark,

		red sage root, forsythia fruit, Cape jasmine fruit, coptis root, poria, dried ginger, cinnamon bark, field thistle, corydalis tuber, curcuma root, saffiower, peach kernel, wild jujube seed, rhubarb, arborvitae seed, bush-cherry seed, polygala root, grass-leaved sweetflag rhizome, ginseng , liquorice, Chinese angelica root, ophiopogon root, lily bulb, light wheat, lotus seed.
Sheep	Small Intestine	bush-cherry seed
Monkey	Bladder	ephedra, triochanthes fruit, pubescent angelica root, ledebouriella root, notopterygium root, lepidium seed, tetrandra root, umbellate pore-fungus, lysimachia, motherwort.
Rooster	Kidney	eucommia bark, psoralea fruit, cinnamon bark, cyathula root, bitter cardamom, arborvitae seed, Chinese yam, moutan bark, dendrobium stem, kansui root, epimedium, hawthorn fruit, fleece-flower root, anemarrhenia rhizome, cistanche, lotus seed, pubescent angelica root, dogwood fruit, lysimachia, coptis root, mulberry mistletoe, notopterygium root, rehmannia root, wolfberry bark, wolfberry fruit, scrophularia root, sweet wormwood, plantain seed, anemarrhenia rhizome, tetrandra root, phellodendron bark, poria, umbellate pore-fungus
Dog	Pericardium	Chuanxiong rhizome, cat-tail pollen, red sage root, uncaria stem with hooks.
Pig	San Jiao	Cape jasmine fruit, cyperus tuber.
Rat	Gall Bladder	bupleurum root, scutellaria root, forsythia fruit, sweet wormwood, lysimachia, oriental wormwood, Chuanxiong rhizome
Ox	Liver	moutan bark, red peony root, black plum, dogwood fruit, schizonepeta, fleece-flower root, mulberry mistletoe, dried rehmannia root, peppermint, mulberry leaf, chrysanthemum, rhubarb, bupleurum root, gentian root, white peony root, sweet wormwood, lysimachia, coptis root, plantain seed, oriental wormwood, cinnamon bark, evodia fruit, motherwort, corydalis tuber, cyperus tuber, germinated barley, field thistle, hyacinth bletilla, notoginseng, cat-tail pollen, Chuanxiong rhizome, red sage root, safflower, peach kernel, cyathula root, wild jujube seed, uncaria stem with hooks, gastrodia tuber, epimedium, eucommia bark, Chinese angelica root, wolfberry fruit.

Table 2: Laboratory use or evolutionary research of animals in the zodiac

Animal	Use in research
Rat	Rats and mice serve as primary genetic models of diseases Rats are predominantly used in understanding mechanisms of Learning and memory tests Rats are also used extensively in addiction studies for alcohol and drugs Cancer models are also created in transgenic rats and mice
Ox	Used to extract fetal bovine serum used in all cell culture experiments Cow eye dissection is used to teach anatomy Milk used as blocking agent in immunochemistry
Tiger	Cats are used to study locomotion and spinal cord control Tiger vocalizations and vocal chords are studied The craniomandibular ontogeny (development of the jaw) is a prime field of study from both a current and evolutionary perspective.
Rabbit	Many antibodies used in staining protocols are made in rabbits The rabbit retina is an excellent model to study vision Is used as a model in Hepatitis E infection and vaccination Eye blink conditioning reflex in rabbits is a standard model of study
Dragon	Dragon is a neuronal adhesion protein Komodo dragon feeding is an established area of study
Snake	Snake venom has new uses in cancer therapy The snake venom was an important tool in understanding neuromuscular control using acetylcholine
Horse	Horses were historically used as model anatomical organisms in medical schools Horses are now being studied as model organisms for depression Muscle control and metabolism are studied using horses
Sheep	Sheep are used in sleep research Hormonal regulation is studied using sheep model systems

	Rams are used to study homosexuality in the animal kingdom Goat serum is extensively used in antibody staining techniques.
Monkey	Monkeys are studied extensively in relation to their visual circuitry Motor control of movement and mirror neurons are studied in monkeys Monkeys serve as models for depression and neurodegenerative diseases Brain computer interfaces are extensively tested on primates.
Rooster	Embryogenesis is studied using chick models Chickens were the model system to study cholera The first onco genes were discovered using chickens We can now create transgenic chickens as their genome has been sequenced
Dog	Pavlovs conditional learning is a famous example of dogs in experiments Dog genomics are powerful to understand evolution Dogs are models for studying hepatic chemotherapy Dogs may also help us understand auto-immune diseases.
Pig	Pigs are used as models to understand cystic fibrosis Pigs are also serving as host models for culturing artificial organs Pig neonatal models are more comparable to humans than mice Pigs are also used to study Inflamatory Bowel disease and other gut diseases

Table 3: Factoids by Animal
Rat • The Rat rules the Gall Bladder • WINTER • PSYCHOPATHY • the Rat are quick-witted, clever, charming, sharp and funny • you should be happy in sales or as a writer, critic, or publicist. • Stewed Cane Rat

Skin and eviscerate the rat and split it lengthwise. Fry until brown in a mixture of butter and peanut oil. Cover with water, add tomatoes or tomato purée, hot red peppers, and salt. Simmer the rat until tender and serve with rice.

- A rat can eat a third of its body weight each day.
- They are true omnivorous scavengers, but mostly prefer grain, livestock feed, and meat.

Ox

- The Ox rules the Liver
- WINTER
- SCHIZOPHRENIA
- the Ox is steadfast, solid, a goal-oriented leader, detail-oriented, hard-working, stubborn, serious and introverted but can feel lonely and insecure
- The Buffalo would be successful as a skilled surgeon, general, or hairdresser.
- Oxtail Stew: Season oxtails with salt and pepper. Add to pot; cook, turning once, until golden brown. Add tomato paste, ginger, garlic, onions, carrot, and celery; cook until soft. Return oxtails to pot with stock, allspice, thyme, and chiles; cook, covered, until oxtails are tender,
- Oxen eat can eat forage, hay, grass, grains
- they can eat 30 pounds per day
- Mad Cow Disease is transmitted from bovines to humans
- Bovine tuberculosis has the ability to affect us.

Tiger

- The Tiger rules the Lung
- SPRING
- Hysteria
- the Tiger are authoritative, self-possessed, have strong leadership qualities, are charming, ambitious, courageous, warm-hearted, highly seductive, moody, intense, and they're ready to pounce at any time

- you would be excellent as a boss, explorer, race car driver, or matador.
- Tiger sauce: Worcestershire sauce, distilled white vinegar, tamarind nectar, hot cherry peppers, sugar, water, Marsala, sea salt, and pectin. All ingredients should be mixed, boiled for three minutes, simmered for 20 minutes, then mixed in a blender.
- They mainly eat large mammals, such as pigs, deer, antelope, buffalo
- A tiger can consume up to 40 kg of meat at one time, but individuals in zoos are given 5-6 kg per day.
- Tiger conservation is an important topic as most tigers across the world are in the endangered species

Rabbit

- The rabbit rules the large intestine
- SPRING
- Schizophrenia
- the Rabbit enjoy being surrounded by family and friends. They're popular, compassionate, sincere, and they like to avoid conflict
- you are successful in business but would also make a good lawyer, diplomat, or actor.
- Place the browned rabbit pieces into the Dutch oven, and pour in the beer and chicken stock. Bring to a boil over high heat, then reduce heat to medium-low, cover, and simmer until the rabbit is very tender, 25 to 30 minutes.
- Wild rabbits spend much of their time foraging in meadows and fields eating wild grasses, herbs, flowers, leaves, and twigs. They also consume some fruits, vegetables, and grains
- A rabbit should be given about 2 lbs. of veggies per 6 pounds of body weight.

Dragon

- Dragon rules the stomach
- SPRING
- PSYCHOPATHY

- the Dragon are energetic and warm-hearted, charismatic, lucky at love and egotistic. They're natural born leaders,
- You would be well-suited to be an artist, priest, or politician.
- Blue dragon**:** Mix 3 parts vodka and 1 part blue curacao with crushed ice, shake or stir, and strain into a martini glass. Garnish with orange slice and cherries.
- Dragons are known to eat any living thing that has flesh. These include bears, killer whales, giant squid, birds, walrus, leopard seals and other animals.
- Dragon boat racing has a positive effect on breast cancer survivors
- The venom in the saliva of Komodo dragons and its role in predation.

Snake

- Snake is in charge of the spleen
- SUMMER
- PARANOIA
- the Snake are seductive, gregarious, introverted, generous, charming, good with money, analytical, insecure, jealous, slightly dangerous, smart, they rely on gut feelings, are hard-working and intelligent.
- Snake would be most content as a teacher, philosopher, writer, psychiatrist, and fortune teller.
- Recipe: kill a viper, skin it, and take out the entrails; cut the flesh into small pieces, put it into the broth, with the heart and liver cut across, two blades of mace, and a small bit of cinnamon; cover it up, and let it boil till it is reduced to a pint; by this time the flesh of the viper will be consumed; then strain it off, and press it very hard.
- Snakes will eat birds, fish, and eggs. Some snakes eat insects and spiders. There is one type of snakes that will eat plants.
- They usually only eat once every 7-10 days, and when they get older and larger only about once a month
- Snakes use infra red "vision" to navigate the world
- Snakes modulate constriction in response to prey heartbeat

Horse

- Horse governs the heart
- SUMMER
- Anxiety
- the Horse love to roam free. They're energetic, self-reliant, money-wise, and they enjoy traveling, love and intimacy.
- You should be an adventurer, scientist, poet, or politician.
  Recipe: In a mix of 90% olive oil, 10% truffle oil, fry sliced onions and mushrooms for 5 minutes. Add green pepper slices, fry 2 minutes more. Throw in a 60/40 mix of shredded roast beef/smoked horse, stir for a few minutes, till the roast beef is browned. Add some black pepper. Add a few slices of cheese on top and put a lid on the pan.
- Horses eat eggs, chaff, apples and carrots, bran, barley, linseed, maize, horse nuts or mixes, cod liver oil, root vegetables, oats, salt, sea weed, dried sugar beet pulp and mollichop
- An adult horse should eat between 1.5-3.5% of it's body weight a day. That comes out to roughly 15-35 lbs for an average 1,000 lb horse.
- Individual recognition amongst domestic horses extends to humans

Sheep

- Sheep govern the small intestine
- SUMMER
- anxiety
- the Goat enjoy being alone in their thoughts. They're creative, thinkers, wanderers, unorganized, high-strung and insecure, and can be anxiety-ridden.
- You would be best as an actor, gardener, or beachcomber.
- Cut the lamb into 8 pieces and flatten with your fist, then toss with salt, pepper and the garam masala. Put into the large frying pan with 1 tablespoon of oil, turning when golden . Toast the cumin crunch mix in the medium frying pan until lightly golden, then pound in a pestle and mortar
- Mostly sheep eat grass, clover, forbs, and other pasture plants.
- sheep eat about 2-3% of their body weight

Monkey

- Monkey rules the urinary bladder
- AUTUMN
- PERSONALITY DISORDER
- the Monkey thrive on having fun. They're energetic, upbeat, and good at listening but lack self-control. They like being active and stimulated and enjoy pleasing self before pleasing others.
- Your sign promises success in any field you try.
- 3 legged Monkey**:** 1 oz whisky 1 oz amaretto almond liqueur, 1 oz pineapple juice, Shake and strain, into rocks glass.
- Some eat only plants, and some eat both plants and animals. They are known for liking fruit, leaves, insects, and other small animals.
- An average monkey eats about 7 pounds a day.

Rooster

- Rooster governs the kidneys
- AUTUMN
- OCD (Obsessive-Compulsive)
- the Rooster are practical, resourceful, observant, analytical, straightforward, trusting, honest, perfectionists, neat and conservative.
- Recipe: With fingertips, separate skin from meat on each breast half. Rub equal amounts of Seasoning Mixture under skin of each breast. Sprinkle chicken with salt and pepper. Place chicken on grill over medium heat, and cook about 25 minutes or until juices run clear when thickest part of breast is pierced with tip of knife, turning over once.
- Chickens are omnivores and will eat grain, seeds, fruit, other vegetation, corns , worms and other insects.
  A laying hen will require approximately 1/4 to 1/3 of a pound of feed every day, or roughly 1.5 pounds of feed per week

Dog

- The Dog rules the pericardium
- AUTUMN

- Dependence Disorder
- the Dog are loyal, faithful, honest, distrustful, often guilty of telling white lies, temperamental, prone to mood swings, dogmatic, and sensitive. Dogs excel in business but have trouble finding mates.
- You would make an excellent businessman, activist, teacher, or secret agent.
- Suyuk(a boiled dog meat):
  Put dog meat and gravy and ingredients into pan, and steam it with a weak fire, eat with sauce. One can eat with boiled
  leek. Perilla powder, perilla oil,mustard, vinegar are
  to be added to the sauce.
- The amount of food that dogs eat will all depend on the weight of the dog. Some dogs will easily eat around 25 pounds of dog food a week and some will only eat 1 pound a week.
- They do eat meat, but they also eat vegetable and grain matter in small amounts.

Pig

- Pig rules San Jiao
- WINTER
- OCD (Obsessive-Compulsive)
- the Pig are extremely nice, good-mannered and tasteful. They're perfectionists who enjoy finer things but are not perceived as snobs.
- The Pig would be best in the arts as an entertainer, or possible a lawyer.
- Heat oil in a large nonstick skillet over medium-high heat. Flatten each pork piece to 1/2-inch thickness using your fingertips. Add pork to pan; spoon soy sauce mixture evenly over pork slices. Cook 3 minutes or until browned. Turn pork over; cook 3 minutes or until done.
- Farm grains such as corn, barley, oats, and wheat make up a balanced diet for a pig.
- Approximately 3-5 pounds per day

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