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Article

Conscious and Unconscious Vision Transmission to Brain over Behavior

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Abstract: Our goal is to apply historical evidence with longitudinal records of human underlining brain led behavior, to compensate for the findings based on conventional brain signal and image measurements taken at a resting position. This compensation, due to unconsciousness, is expected to play a major role in one's decision making process. Using masks to distract vision, also measuring facial muscle movements, we were able to separate cognition through conscious and unconscious vision. Two types of masks are used over face image arrays under different cultural backgrounds to exercise 3 sequences of tests: (1) randomly generated masks anterior and posterior to target images; (2) Tai Chi Tu as masks, to take cognizance of longitudinal changes of the environment; (3) for each mask, contrasting European and Asian perception of facial emotional images. Our proposed approach is an attempt to investigate spatio-temporal effect about brain decision-making when historical evidence is considered to provoke the unconsciousness. Evidence and environmental influences over brain are commonly transmitted from vision. By masking vision at varying epoch, rates of longitudinal changes are examined for impact on perception, even when these rates have not been normalized for testing. Some justification of mask usage, its exposure duration and frequency are designed into our testing procedures for sensitivity studies. Significantly more testing is expected to understand the ambiguity between unconscious and conscious vision and to justify the proposed type of longitudinal changes on brain triggered behavior.

Keywords: Unconscious Vision, Facial Muscle Movements, EEG, EMG, EOG, Brain Triggered Behavior, I Ching, Tai Chi Tu, Haxagram, Ba Gua Tu

1. Introduction

Publications of brain investigation applying Convolutional Neural Networks (CNN), Machine Learning, Deep Learning (DL), Artificial Intelligence and Computer Vision (CV) techniques have been accelerated since 2018 [1–3]. The underlining brain process, regardless of terra bytes of available ElectroEncephaloGraphy (EEG) and Magnetic Resonance Imaging (MRI) datasets from the open source, remains difficult to access and results unconvincing. Case in point, IEEE Brain Initiative conducted many years of Brain Data Bank (BDB) Challenges [4–7], only to find out most brain datasets were substantially inadequate for CNN modeling when applying the highly touted DL and CV techniques. Acclaimed progress in brain image classification has been hard to reproduce [1].

The goal of this paper is two fold: to seek evidence based brain-behavior connection through vision; specifically, the unconscious vision and longitudinal evidence; of which existing brain datasets are commonly lacking. We are set to explore not only the conscious, but the unconscious vision; and to apply practical longitudinal records of human underlining brain led behavior to reflect changes of one's decision making process.

Vision is the primary sense to trigger brain reaction. Human vision provokes brain to react consciously and unconsciously, the latter can be falsely blended with noise, interference, distraction and other habitual influences, all attribute to form one's "perception." Social and environmental factors can be major contributions to unconscious reactions. This paper uses masks to distinguish vision and to measure facial muscle movements linked to the unconscious brain reactions.

"Seeing is believing!"—It might not be so as the amount of information entering our brain directly from the retina is much larger than our memory capacity. An approximate estimate of this volume has been obtained by multiplying the upper cutoff frequency of impulse rate of axons in the optic nerve and the number of fibers in the optic nerve, which yields 4.56×10^6 bps [8,9]. These experiments dated half a century ago also realized that conscious data retrieval from the memory section of the brain is

dramatically less than those derived from the entire vision even when the primary channel of perception (unconsciousness) plays a major role in one's decision making process.

Verghese P and Pelli D. [10] disclosed that the "processor" (brain) of the selective attention was the bottleneck of the visual system channels which could allocate only 30–60 bits of information, shrinking the obtainable data to almost 5 orders less used. Their findings beg the question whether most brain data available in the form of EEG signals and MRI images could ever have constituted $1/10^5$ information through the brain, if taken when eyes were closed.

In recent years, special attention has been paid to channels transmitting unconscious information as illustrated in Fig. 1 [11].

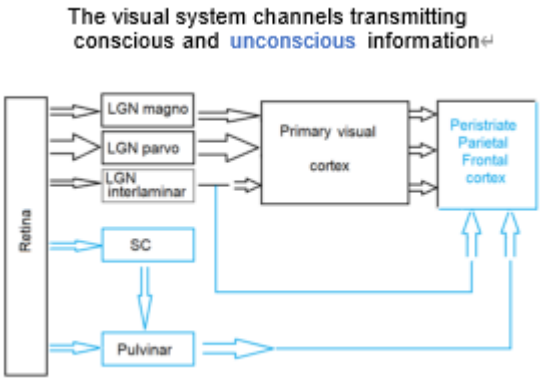

Fig. 1. Vision Transmission to Brain: Conscious information follows per diagrams in black and unnconscious, in blue.

It should be noted that unconscious information largely determines the "intuitive" assessment of the spatial and longitudinal-target situation in human decision-making. Fundamentally any change in the space we live, atmospherically, geographically and socially could play a role. These attributes might exhibt different time references for impact to occur.

Evidence of human behavior under the influence of universal and social changes has been recorded in Chinese I (pronounced as alphabet "e") Ching [12], which provides traditionally highly respectable guidance for survival and/or change in life. This guidance book is dated at least twice as old as the Bible. Elegantly, I Ching is popularly pictured in swirling black and white shaped with equal but curved footage in a sphere, named Tai Chi Tu (diagram), as showing in the center of Fig. 2. This famous sphere represents perpetual expansion and contraction, a cyclic evolution experienced through human societies and the universe. I Ching further captured human behavioral changes in a 6-level binary splitting scheme (2^6), yielding 64 code Ba Gua Tu. Each code is represented by a stack of 6 keys, also referred to as hexagram. (We use Ba Gua codes and hexagrams interchangeably in this paper.) Each key can be either Yin or Yang, denoted by a dashed or solid bar, analogous to 0 or 1 in a binary system. Sixty-four hexagrams (also referred to as Yin-Yang codes) are shown on the outer circle in Fig. 2, and its binary code expansion (null, 2, 4, 8, …64) are shown from the center Tai Chi outward. The 64 codes serve as pointers into records written in heuristics, illustrated with story-telling pictures, registering clues through universal changes tracing back to thousands of years of experience and scholarly studies. It's this longitudinal, accumulative evidence and experience of which we attempt to make use for the differentiation between the conscious (telescopic) and the unconscious (periscopic) vision. One must also observe that I Ching offers three fundamental principles of human reaction: "simplicity", "permanence" and "perpetual change." These principles can become our tools in explaining the information transmission from vision to the brain.

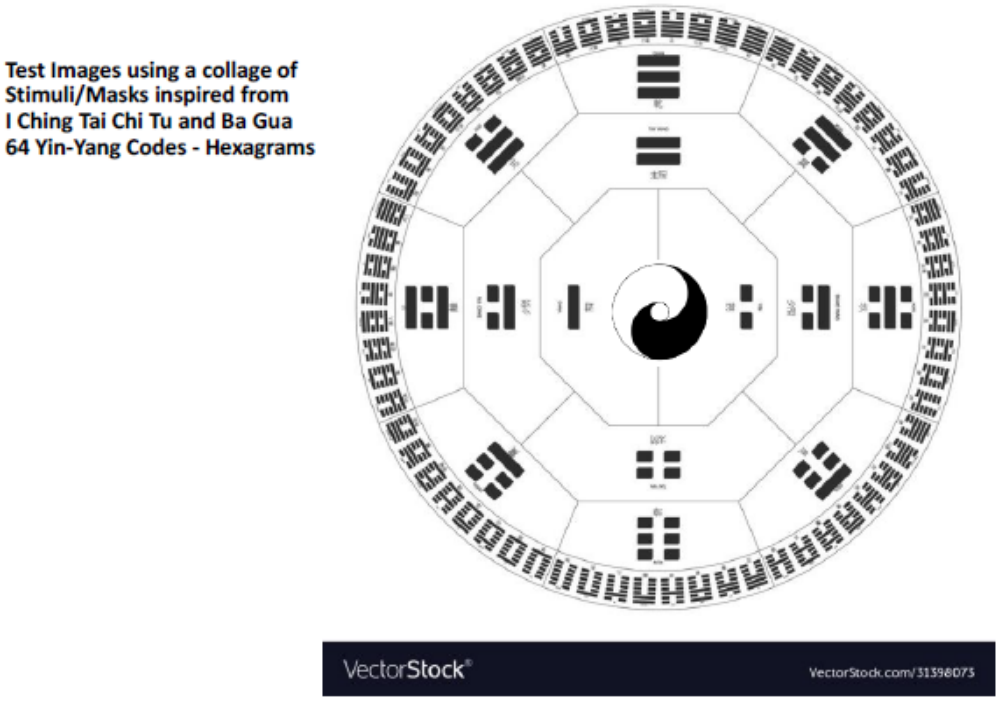

Fig. 2. A collage of masks inspired from I Ching for provoking unconsciousness.

Circumstances often arise where uncertain and conflicting outcomes are manifested in many analysis of brain mapping data, e.g., EEG and MRI. Notwithstanding noise and artifacts, many (including us) continue to apply DL, CNN and CV techniques for classification of human emotions and cognition, but in vain. One realizes that brain reactions are a continuum, often subject to influence from surrounding factors. Existing brain measurements rarely manifest the unconscious brain reaction, and longitudinal consequences are hard to track. In fact, most scientific procedures imposed by brain imaging techniques often isolate brain functions from the surrounding reality.

I Ching has documented human behavior guidance resulting through life's struggle by gathering knowledge from astronomy, climatology, geography, algriculture, anthropology, and academia over thousands of years. It provides rich evidence about human behavior in history. It can serve as a source of behavior longitudinal data seen through eyes. How do we apply the I Ching macroscopic evidence to help with brain decision making is the task at hand.

Selective activation of the assumed channels of unconscious origin under the environmental influence is deemed to contribute to decision-making when exercising through a human's mind. Physiological signals of EEG, ElectroMyoGram (EMG), ElectroOculoGram (EOG), MRI, Positron Emission Tomography (PET), etc., are obtained from practices only to record human brain functionality for the moment under specific instrumental control. Longitudinal recording has been difficult to collect, let alone to integrate. We propose masking, to introduce the longitudinal projections from a human decision-making point of view, taking advantage of the evidence drawn from a long-lasting, well-entrenched practice of I Ching in Asian. Our hope is to not follow the conventional machine vision approach, but to examine the brain decision-making on account of the vision transmitting bandwidth (specifically on account of perception.)

Sections that follow explain randomly-generated versus I Ching masks, both are designed to distinguish unconscious from conscious cognizance of emotions. Tests are designed to record EEG, EMG, and EOG after mask priming with target face arrays. Testing procedures are described involving recording interplay of vision and facial muscle movements, after exposure to a mask priming stream designed to provoke perception. Validity of using I Ching masks to introduce longitudinal attributes is contrasted with the randomly-generated masks. Upper bounds of the results are discussed. Future work is suggested to further identify the unconscious vision impact on brain decision-making and to stir more inspirations in addressing longitudinal changes of the brain.

2. Background

Recent studies [1] about brain deterioration have borrowed techniques from DL and CV techniques for classification of EEG, MRI and PET images. However, the number of brain samples was insufficient and validation basis was skimpy to legitimate many

well-published results [1]. Some also combined clinical data in terms of weighting coefficients and machine learning rates under advanced CNN modeling efforts [2]. Research has also been designed to digitize an individual's biography to provide insights into one's brain condition, although in a primitive stage.

J. Haidt [13] argued that “the human mind is a story processor, not a logic processor,” and we each had a story of ourselves that we used to reconcile our place in the society. Furthermore, studies have increased attention to distinguish the unconscious versus the conscious brain during the last decade [14–17]. It should also be pointed out that unconscious information largely determines the intuitive estimate of the target environment in one’s decision-making process.

As shown in Fig. 1, it is less understood that perception of information at the periphery of the field of vision is not always conscious, and it is sometimes impossible to extract it from memory. In fact, the information stored in human memory concerning observed scenes can conventionally be separated into two types. One type of information concerning images is accessible at the conscious level. The other type is hard to extract by conscious efforts [15,18]. This “missing” information of unconsciousness influences the process of decision-making, planning, organization, and control of movements, since certain spatial and temporal properties of the images of the surroundings (instantaneous as well as protracted) are required.

Recently, more impact was attributed to clinical, behavioral and environmental [21] data besides EEG, MRI, PET and other electro-magnetic signal extractions from the brain in neuroscience. Information collected, ready for integration, includes social demographics; clinical characteristics; cognitive or neuropsychological features; behavioral or psychological factors; cardiovascular risk factors; genetics; biological markers, etc.[19,21].

Some of the brain cognition has been experimented through vision tests using random masks to demonstrate conscious and unconscious brain reactions [11]. Such separation could uncover highly intertwined mechanisms within the brain leading to the understanding of human reflections and perceptions. These and other separation schemes have remained in discovery mode, waiting to be validated based on obtainable evidence. Even though recently we have scrutinized many open-source brain datasets [1–7] for classification and validation, large open source datasets seldom address the unconscious vision, simultaneous multi-modal senses, or longitudinal brain records.

We found the resemblance of the amplitude spectroscopic diagram between human faces and Tai Chi Tu. It prompted us to take advantage of Tai Chi Tu which has links to evidence compiled in I Ching, the ancient Chinese book on guidance of changes. The wealth of experience manifested through I Ching [12] could help explain some of the paradoxes we observed in the brain decision- making process.

Our concept of masking might be the first attempt to cause vision ambivalence using Tai Chi Tu. However, use of I Ching Ba Gua hexagrams in scientific pursuits dated back to the 17th century. I Ching was introduced from China by Gottfried Wilhelm (von) Leibniz (1646–1716). His introduction was limited to comparing the European binary scheme mathematics with the generation scheme of 64 compound codes (hexagrams). I Ching’s philosophy was left untapped in its offering guidance of perpetual changes through time and space.

Yin-Yang pattern in hexagrams were also being contrasted to Genome and DNA coding by French, Chinese, Japanese scientists, from 1973 to 2006, to show close correlations. Fig. 3 illustrates examples of Chinese medicine practices using Yin- Yang symbols indexing into I Ching guidance rules seeking for treatments. These fully entrenched practices, old and recent, motivate us to further apply the 64 hexagrams for the interplay of unconsciousness (intuition) from consciousness (reasoning) in human cognition. Behavioral changes are primarily driven by brain through vision; and intuition or impulse can be induced by seeing environmental changes, in short and long terms.

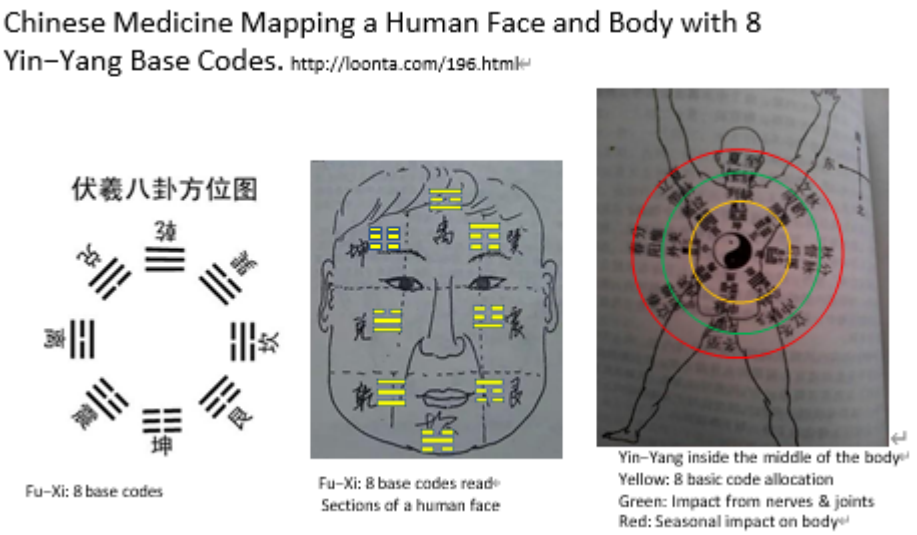

Fig. 3. I Ching Ba Gua used in Chinese Medicine sickness detection.

Will brain, envisioned by our eyes, be intrigued by a Tai Chi Tu mask hiding the target? Ocular and facial expressions typically feed into brain conscious reactions a priori and possibly a posteriori. Our attempt to explore longitudinal brain evidence in past and future times has better be validated by recorded experience of which we draw from Ba Gua Tu priming. We seek for scientific validation and further testing by experimenting with an operative bouquet of masks taking shapes from these 64 hexagrams.

3. Methods

Unconscious vision is informative, but non-trivial to capture. It is best demonstrated in interference, distraction, repetition, and with camouflage effects. We first injected random masks (M) to provoke unconscious vision in light of consciousness, as shown in Fig. 4. Four different faces of the same emotion were arranged in an array as the target image array (E). Priming was done with either happy or sad face array intertwined with at least 2 masks, anterior and/or posterior. The testing picture stream (denoted by P, for "picture" or "plain", after 2.5s in Fig. 4) consisted of only plain (emotionless) face arrays and the observer was forced to select either "happy" or "sad" button in response to the group emotion shown on each picture array. Separation effect due to unconscious and conscious vision was thus achieved by use of masks, introducing incoherent emotional face arrays between priming and testing, and varying the epoch for displaying M and E array images. The initial findings indicated 30~50% cognition attributed to unconscious vision, which was substantial, however lower than former studies' anticipation [8–10].

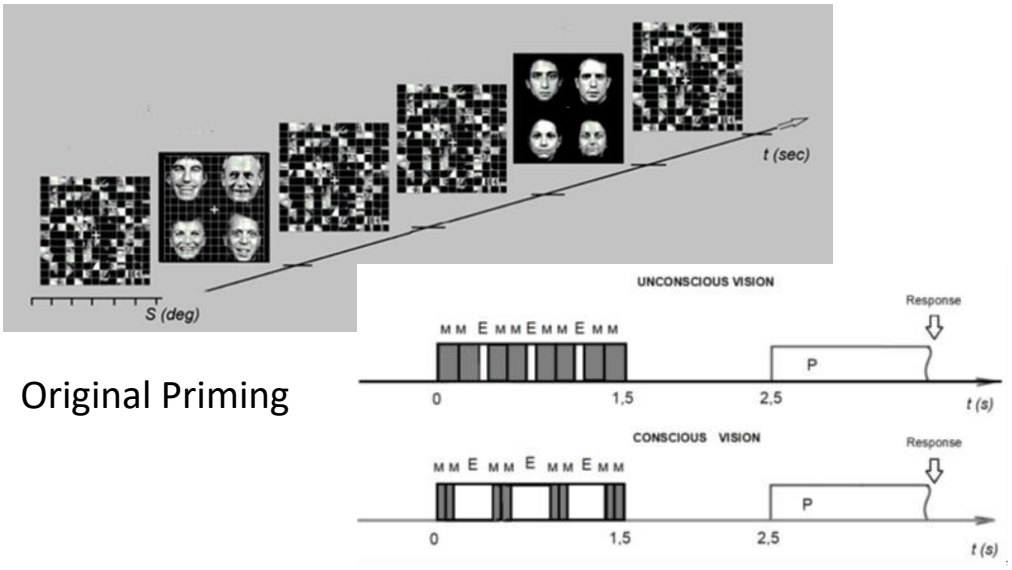

Fig. 4. Alternating projection of Masks(M) over Emotional(E) images at varying epoch before testing.

To further provoke the unconscious vision, we modified the above method by introducing 4 orientations of Tai Chi Tu on mask array,-namely 4 “moon”-faces on a frame. These new masks are designed to observe the entrenched cultural influence among those who are familiar with I Ching guidance and those who are not. Our new series of tests are aimed at injecting evidence and deep-rooted philosophy to reveal more impact due to the unconscious vision. This philosophical induced perception brings a longitudinal effect carrying thousand-year history onto the moment of testing. It is believed to channel unconsciousness better than random patters, or such is to be proven. The fact that Tai Chi Tu shows similar space-frequency spectrum to a human face further encouraged us to use, thus is our design as shown in Fig. 5. Target Asian emotional facial expressions will be tested in parallel to European. The effect of cultural difference reacting to Tai Chi Tu will be explored to contrast previous results based on random mask containing no emotion.

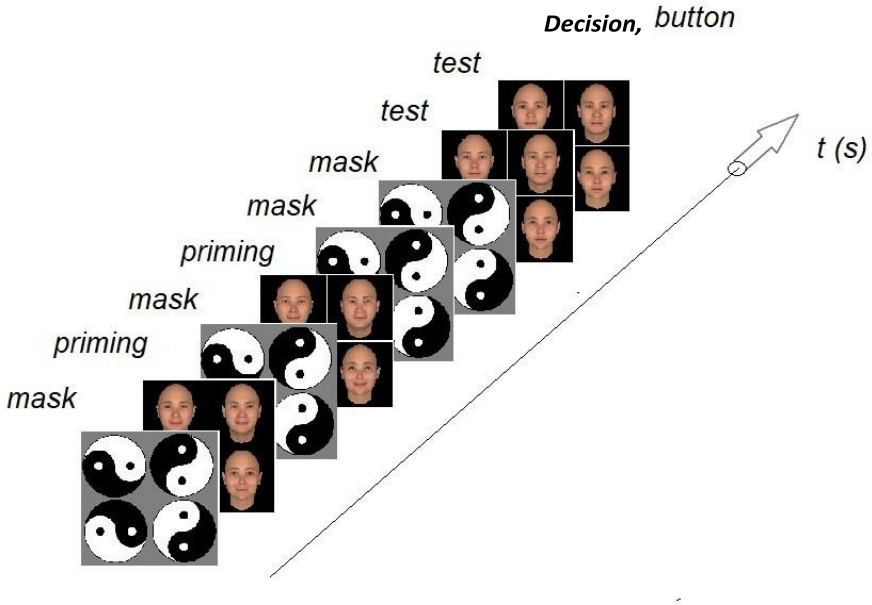

Fig. 5. Masks using Tai Chi Tu to stimulate Perception with Asian targets for Asian observers.

The epoch to display masks can be administered to discover memory recall latency of unconsciousness. By varying the epoch for displaying masks versus the target emotional images, the effect of unconsciousness and consciousness can be revealed when the observer identifies a series of emotionless arrays after been primed. In the original priming stream, the display epoch for M and E arrays was short and long, respectively, for consciousness testing; and vice versa for unconsciousness testing. For example, the display epoch for each mask array was 58 ms and 167 ms for conscious and unconscious vision, respectively. The subsequent display epoch for target emotional array image was 333 ms and 42 ms, respectively [11]. One-second pause after being primed, a stream of emotionless array images was displayed and the observer was required to select between “happy” and “sad” emotions when observing the emotionless face images. Responses were recorded from 12 observers to obtain statistical significance.

For the new series of testing, we realize consciousness and unconsciousness can have overlaps, the display epoch is systematically varied at multiple increments of 60 ms for mask and target images, to fine tune the test results between consciousness and unconsciousness. Use of either random mask or Tai Chi Tu mask is conducted for observers with different cultural background. The conscious and unconscious responses from an observer; be it spontaneously or sustainably, are distinguished after a stream of 40 emotionless images are projected. Analysis of these results from this series of image stream tests provide further insights into the interplay of consciousness and unconsciousness, the effect of mask selection, the observing period, and any cultural impact resulting from longitudinal evidence.

3.1. Masks

Masks can be selected from:

- Random—Arbitrarilly scrambled patterns, an example is shown in the first (left most) block of the priming stream in Fig. 4;
- Tai Chi Tu—symbolize I Ching where an ancient form is shown in the center of Fig. 2;
- Yin-Yang Codes (hexagrams)—from I Ching Ba Gua Tu, as shown along the periphery in Fig. 2;
- Other stimulus of perception rooted in evidence/belief carrying longitudinal information.

As many as 8 masks has been used in the priming stream, none in the testing stream following a 1-sec pause. These 8 masks are enveloped around 3 target face arrays of either all happy or all sad emotions. The priming stream is well known psychologically to provoke interference, distraction and camouflage effects, creating perception that might lead the observer to mistakenly select an irrelevant emotion when staring at a series of emotionless arrays in the test stream. We only use random and Tai Chi Tu (with 4 rotations) as masks in our current design. Other choices from an operative bouquet of Yin-Yang codes and varying number of mask arrays will be incorporated. Operations on Ba Gua codes are exemplified in basic form in Fig. 6.

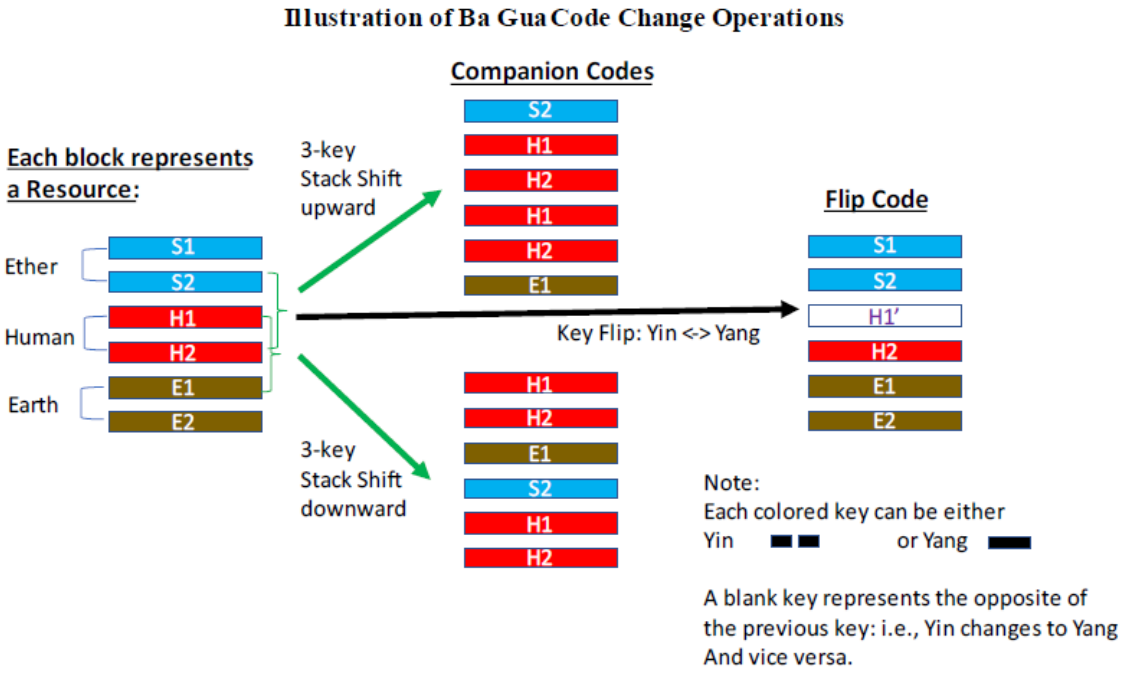

Fig. 6. I Ching—Ba Gua Change Operation Dynamics

3.2. Target Images and Test Images

Target images can carry "happy" or "sad" emotions; European or Asian faces, all inclusive. Each array contains 4 faces of the same emotion: "happy" or "sad"; from the same cultural background. There are 3 target images of the same emotion, wrapped around with masks, in each priming stream. Test Images after priming are always of emotionless, but the observer has to choose either "happy" or "sad" in their decision making. Neither answer is correct, but the observer is primed to form peculiar perception when displaying masks at significant longer epoch than targets. The impact on decision-making due to perception, using masks carrying evidence and experience of significance (e.g., Tai Chi Tu), or the lack of it (e.g., the random mask), would be examined.

3.3. Epoch for Masks, Target Images, and Test Images

The priming stream consists of mask arrays, target image arrays, and a set value of frequency and epoch associated with each array display. The priming stream forms a repetitive pattern of 2 masks and 1 target array for 3 times. Cognition based on consciousness requires observation with the least interruption; thus, little time (e.g., 60 ms) should be allowed for masks to introduce distraction. The opposite is true on unconsciousness, which assumes 6 times longer exposure time for the masks than for the target (6 also coincide with 2^6 level binary construct in I Ching Ba Gua Tu, Fig. 2.) Thus, the epoch for mask and target interval starts at 60 ms and 360 ms, respectively, for conscious, and vice versa for unconscious selections. Sensitivity studies of the epoch and number of masks other than the above stated arrangements could be investigated in future work to further distinguish conscious and unconscious decisions.

The above priming stream setup is known for drawing unconsciousness through perception [11]. But the introduction of I Ching for priming allows one's inherent belief to play a role in the test response. It is noted that I Ching's time scale of changes would not be aligedn with the relatively short test response time. The memory recall of the prime target images potentially would bring unconscious decision making into the limelight. These scenarios would be manifested and evaluated in test results.

4. Discussion

Using our experiment design based on "happy" and "sad" emotions, we would expect unconscious vision to contribute above 70% in decision making, as explained below:

(1) I Ching has systematically compiled 64 hexagrams which provide change agents deriving from 3 resources: the ether, the human and the earth, as illustrated in Fig. 6. I Ching's construct of the hexagram took resources from environmental factors above and below (ether and earth) surrounding humans. Treating these 3 resources with equal impact, we easily assume that a change in one's behavior would derive 1/3 from one's consciousness. The other 2/3 would come from one's perception of the space and time surrounding oneself;
(2) Tai Chi Tu, its amplitude spectrum resembling that of a human face, might better serve as a stimulus than a random mask of no emotion, particularly for testing cognition about emotions. Furthermore, Tai Chi Tu carries longitudinal progression as its premises are all about the perpetual change;
(3) Conscious and unconscious vision effects might be intertwined and overlapping. As illustrated in Fig. 1, the peristriate parietal frontal cortex receives input from both the primary visual cortex and the pulvinar. We could check out the range of perception dominance in emotional cognition by systematically varying the epoch for mask and target image exposure during priming;
(4) Advanced masks are sought to properly incorporate longitudinal effect in one's decision-making process. This approach is different from many CNN modeling with DL extensions where exhaustive computational power have been employed; but most of these modeling efforts have limited sample input of brain data. In most of these CNN models, vision transmission to the brain is not considered;
(5) Facial muscle movements can reveal the hesitation in making a decision after priming. Perception of an emotional image might be more accounted for through EMG than EEG or EOG. These signals simultaneously measured would facilitate a multi-facet assessment of one's decision making. EMG data from tests using the random mask are further described below.

4.1. Facial Expression Highlights Unconscious Vision

With the random mask, we checked responses from the control of involuntary eye and facial muscle movements of the observer to reveal unconscious signals impacting the decision-making process, planning, organization and control of movements. The environmentally caused perception was initially evaluated in a microscopic scale. To extract the priming information from memory, objective research methods are required in terms of optical or electrophysiological measurements, e.g., EMG. Fig. 7 shows the testing result where EMG measurements, after priming, return to the same level under conscious pereption (curve 1 in blue), while continue to proliferate under unconscious perception (both blue and red curves in Fig. 7 do not converge to 0). The muscle movement associated with smiling is activated after priming with smiling faces. With sad faces, its relative magnitude stays in the negative range after priming. It should be noted that this contrast is magnified in the case of unconscious perception (Fig. 7B). Moreover, the priming stream continues to have an unconscious effect even when the target images are no longer being presented. Emotionless faces started being presented to the observer after 2.5 s, thus the responsive facial reaction disappears from the observer (Fig. 7A). However, if unconscious priming with a pronounced expression (happy or sad) had been presented before the testing stream, the observer continues, even looking at the emotionless faces, to smile or look sad, according to what had appeared to him in priming. The response to happy or sad faces now significantly differs in amplitude in the first second of the testing stream (Fig. 7B).

In these studies, priming had the observer register an emotional tone in the memory prior to looking at the emotionless faces. However, priming did not influence the observer's choice when perceiving emotionless faces. When a choice was mandatory, the observers' responses were equally divided between happy and sad faces. This means that the observer did not consciously ascribe an emotional tone to the perceived emotionless faces. The indifference to the emotionless facial expression was too pronounced at t~ 3 s, 500 ms into the test stream as shown in Fig. 7A, where EMG converged. In the case with uncousious stimuli, EMG increased ~2.5 times when primed with happy faces, and decreased ~4 times when primed with sad faces. Priming effect lingered well into t ~3.5 s, and the reality of looking at emotionless faces, 1 s into the test, did not matter. The unconsciousness signals differ in their optical (spatio-temporal) characteristics and it shows they transmit different information to the brain.

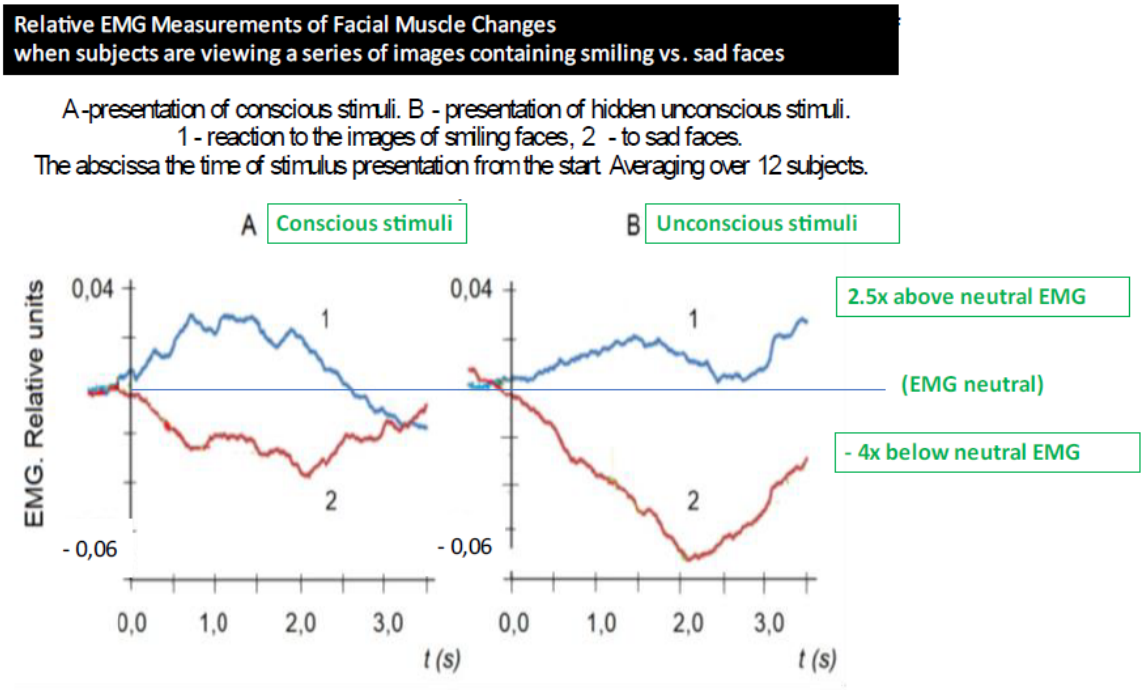

Fig. 7. EMG profiles from the random mask setup.

The environmental impact can be inherent with the observer, in a macroscopic scale; while sensor extracted signals via brain computer interface (be it EEG, EMG, MRI, etc.) happen at the time of testing, in a microscopic scale. Our new mask model incorporates the macro- and the micro-time impact to capture the interplay of vison transmission to the brain, in systematic stream formats, mathematically, longitudinally, and physiologically.

Mathematically, we start the prime stream for vision with Tai Chi Tu arrays as masks. We then engage the 64 hexagrams drawn from I Ching's accumulation of astronomy, climatology, society and geography knowledge to claim longitudinal information. A new mask consisting of 4 hexagrams will be used to stimulate unconsciousness in addition to the physiological data taken in a resting state. The heuristics and pictures in I Ching are left untapped, as they are more cultural oriented. Hexagrams in our case are really meta data of the longitudinal data. Through experiments we hope to discover a legitimate correlation between resting and dynamic measurements. Thus, a Yin-Yang code construct out of a bouquet of 64 hexagrams will be chosen as the observer's operand based on many well-known methods from I Ching. This operand code does not work alone. It is impacted by its companion, supporting and flip codes, all 4 codes together to form the new mask array. Some examples of code operations are shown in Fig. 6 for the generation of the companion, supporting and flip codes. I Ching change operations can be compared to Walsh-Hadamard Transform [20] for real numbers ≤ 64. Here we are creating a new scheme to combine the ancient mathematics with the powerful Fourier Transform for assessing vision and brain communication, but limiting the expansion to 64, most likely down to single digits for an individual. This is the wisdom foreseen by I Ching, not a restriction, to be proven with experiments.

4.2. Rate of Changes based on I Ching Construct

Environmentally, we acknowledge human existence is not only constrained in the society we know, but influenced by the atmospheric and earth movements. We do not use the micro-controlled environmental data during the short test alone. Human perception can unconsciously process any instantaneous change, bypassing logic, to survive a catastrophe, e.g., earthquake or tsunami in extreme cases. In the encounter of changes, each key of the hexagram and the possible change rate associated with various resources can be modulated, for demonstration purposes, as illustrated in Fig. 6, where S1 and S2 represent resources from the ether; H1 and H2 the human society; and E1 and E2 the earth. Some records of annual change rates of our environment in modern science are accessible publicly. Some records hidden in I Ching can be illustrated below:

d(S1)/dt ~10^{-17} (universal fine structure change constant)
d(S2)/dt = 10~26.6. (severe weather related changes/year)
d(E1)/dt = 10^{-20}~0.0004 (geographical movements under the horizon/year)
d(E2)/dt = 0.07~120 (geographical movements above the horizon/year)

Note the rates of change can be miniscule or drastic and human brain reacts to environmental changes best seeing through eyes. Sensible depth of vision recalled from memory is known around 7 ± 2. The 6 levels of binary scheme administered for changes, large or small, within the confine of I Ching serve our purposes with practical bounds. In another words: the change of any state can start from oneself (BCI measurements) and will not exceed 64 possibilities captured by I Ching.

For H1 and H2, the human resources in the middle of a hexagram, can take the values of EEG, EMG and EOG, thereto leading to a controllable calculation of the corresponding rate of change: d(H1)/dt and d(H2)/dt, gauging for conscious reaction in short term as well as long term. The algorithm to apply the rate of changes into a hexagram mask design (composed of a chosen hexagram and 3 affiliates, as an example) is planned for future work.

4.3 Masking Target to Stimulate Unconscious Vision

In our preliminary tests, the total array stream time was less than 1 min, of which 1.5 s is used for priming involving masks, 1 s pause for the perception effect to sink in, and the effect of perception was shown hightened 500 ms into testing, after pause.

The mask exposure epoch was roughly 1.3 s in provoking the unconsciousness. The impact on the accuracy of emotional cognition due to unconscious vision had been measured in EMG at a difference roughly 2.5~4 folds [11]. Based on I Ching's construct where the environmental attributes constitute at least twice the impact on behavior changes, we have yet to find out from these tests the unconscious impact; whether it would linger around 2 folds after 1 second into testing, i.e., unconscious decision outweighs conscious by a factor of 2.

The masking mechanisms require further scrutiny:

i. Number of masks: 2 types of masks: either randomly generated patterns or Tai Chi Tu, the latter can imply I Ching evidence into the decision making process of emotional cognition for those who are indoctrinated with these symbols. Would the I Ching ancient practice play less impact on modern Asians, even when many of them still believe in this philosophy? Would Tai Chi Tu mask impose no impact on Europeans due to its unfamiliarity in the western world? Would there exist an I Ching equivalent in the western culture? We compare the random mask with an evidence-based mask to distinguish Chinese and European observers in cognition of emotions;
ii. Epoch to display mask: For conscious vision, the exposure time for a mask is set about 1/6 of that for a target image array. For unconscious vision, epoch for mask display is 6 times of that for the target image. The latency for the memory to register any perception for decision making will be varied and validated in our vision-brain-behavior experiments;
iii. Within the short testing time, could the lingering effect of masks and targets be sustainable in memory? The pause period of 1 s before the series of emotionless image projection might reinforce or dampen the stimulated perception of the observer. Unconsciously received and prior information rooted in the memory can influence the main process of decision-making, planning and triggering of movements. Analysis of involuntary movements shows that it is possible to claim that the unconscious stimulus involving the surroundings could have existed in memory ready to be recalled for decision making. Unconscious influence is particularly strong in conditions of uncertainty and disaster. Our experiments break down the time interval for vision reception of mask, target and test arrays for judgement; all these timing factors are subjects for sensitivity studies to better distinguish the unconscious from the conscious vision.

Physiological pursuits about the interaction of central and peripheral vision can thus propose a new system of unmanned vehicle control. Peripheral vision selects an area of interest in the field of view and gives a signal for reaction. The new artificial recognition and control systems confirm that periscopic vision is based on assessments of the macro situation. It provides prediction and personal bias in decision making at the bifurcation point. Our choices of masks can further excite these periscopic vision channels which could lead to a more intuitive control principle aiming for safer and more productive system design.

The use of Tai Chi Tu as mask and, furthermore use of hexagrams, would open up a new approach seeking for more brain bandwidth. These mask choices might not present the ultimate stimuli, but evidence and longitudinal data are necessary in advancing brain state classification and decision making analysis. A mathematical sheme to harmonize longitudinal data in short as well as in long time frames will be novel for perception-oriented data analytics. Coupled with experimental results, we reveal and validate the unconsciousness driven decision-making process.

5. Conclusion and Future Work

This paper formulates a strategy to separate and validate the unconscious from the conscious mind through vision by using 2 types of masking: one is randomly generated and the other is evidence-based. The evidence-based mask introduces Tai Chi Tu from the Chinese I Ching for human behavior guidance against changes of surroundings. Many settings have been investigated for stimulation and appreciation of the unconscious vision. These settings, to stimulate perception, involve varying the mask, the epoch and frequency in display, heterogenous composition of mask and target images, and memory latency to expose influence of the peripheral over central region of the retina. A total of 6 test designs are under way to acquire EEG, EMG and EOG recording simultaneously in novel context and to substantiate unconscious from conscious decision-making with instantaneous and prolonged memory recalls. We have revealed unconscious EMG effect up to 4 times of the conscious visualization of emotional faces. We also observed that the primed perception lingered beyond 1 s.

I Ching hexagrams are still popular in practice in many Asian countries thousands of years since its inception. Its ingenious construct integrates human behavior with the natural environment and society. Behavioral changes guided by I Ching are genuinely perceived through vision which induces brain processing. Other evidence-based philosophy from different cultures might also be candidates for masks to be used in the priming stream we have designed. To substantiate I Ching masking or other similar mechanisms, further tests to cover scopes described in Sections 3 would be advised to include not only emotion differentials, but other physiological reactions for holistic investigation.

We find our approach necessary to explain some inconsistency exhibited in many brain data and processing analytics. Sampled papers dating between 2015 and 2020 [1], with terrabytes of MRI image reservoir [7] demonstrated average performance matrix for brain feature classification using CNN ranging from 83%~92%. These results present low value when longitudinal data are insufficiently addressed. Furthermore, few of these publications have considered unconscious vision transmission to the brain. We look into recorded evidence to show missing unconsciousness measurements which could amount to 4 times uncertainty.

Our unorthodox approach could also lead to refinement in the popular pursuit of CNN modeling in brain research. A study resemblying the Walsh-Hadamard Transform with an upper bound of 64 might identify more meaningful machine learning rates, weighting coefficients, and the epoch for convergence: many parameters that are pivotal in saving computational power and dealing with limited validation sources.

Among our research goals is also to propose a new system of automatic vehicle control using the interaction of central and peripheral vision leading to a more intuitive, safer and productive system design in the real world.

Author Contributions: N. Chu contributes to conceptualization of longitudinal data utilization of I Ching, methodology validation, supervision of data analysis, visualization and writing. Y. Shelepin contributes to experimental design to detect unconsciousness, vision-brain conceptualization and methodology, investigation, resources; data curation, software, visualization, and the overall supervision of the work reported here.

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