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Experimental Design to Assess the Existence of Chakras

John Sadi

john.sadi68@gmail.com

https://orcid.org/0000-0003-3480-6814

Lightnics Sarl, Lunel, France

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HIGHLIGHTS

A new research design aims to overcome the limitations of past studies on 'chakra energy fields' in order to advance scientific knowledge of this understudied topic.

ABSTRACT

The existence of the chakras and their associated energy fields is admitted by oriental tradition but has never been scientifically and convincingly demonstrated. After showing the weaknesses of past attempts toward this goal, the author describes preliminary experiments which enable to better specify behavior of the chakra energy field. From these empirical results, a new experimental protocol is carefully designed and proposed, along with the relevant statistical analysis. The main experiment detailed here relies on randomly generated trials monitored by a computer to ensure that the double-blind criterion is met.

KEYWORDS

Chakra, chi, prana, biofield, bioenergy field, subtle energy, body's energy

The chakra concept forms part of yoga philosophy and practice. As is known from historical data, yoga and chakras were mentioned across different yet contemporaneous philosophical and religious systems in South Asia. However, from one belief system to another, yoga and chakra descriptions remain surprisingly close: "Although traditional yoga rarely, if ever, occurs outside of particular religious and doctrinal contexts, these contexts vary considerably, while yoga itself retains essential theoretical and practical commonalities" (Mallinson & Singleton, 2017, p. x).

Among the Muktika canon comprising 108 Upanishads sacred texts, there are twenty chapters concerning yoga and chakras, the Yoga-Upanishads. Yoga practice is notably described in the Maitrayaniya (1st millennium BCE), the Shvetashvatara (5th century BCE), and the Kundalini Yoga Upanishads. Although the Kundalini concept is mentioned as early as the 8th century CE, in the Netra-Tantra, it is thought that the Kundalini Yoga Upanishad is one of the later groups to have been added to the Upanishads, around the 16th century CE (Mallinson & Singleton, 2017). Other sources for yoga practice and philosophy are the *Bhagavadgita*, from the 3rd century CE (Mallinson & Singleton, 2017), which occupies chapters 23 to 40 of Book VI of the *Mahabharata* (Doniger, 2021), and Patanjali's *Yogasutras* thought to be written between the 2nd century BCE and 425 CE (Flood, 1996; Maas et al., 2018). Chakras were first described as wheels related to Brahman in the oldest scriptures. Later, they were mentioned in connection with a yoga practice first in the *Netra-Tantra* (chapter 7) dated to the late 8th century CE (Flood, 1996).

The current representation of the chakras dates back to 1577, when they were first described by Purananda in his *Shat-Chakra-Nirupana*, in relation to the energy flow along the nadis close to the spinal cord (Motoyama, 1981). Purananda describes the Kundalini awakening as this flow of subtle energy along the spine which provides energy to all the chakras on its path. It may be surprising that even if the chakras have been known about for such a long time, "there is no explanation of how non-physical chakras influence physiological function. Even more there is no valid scientific study that proves that the chakras,

or anything like that, really exist" (Ristovski & Davidovic-Ristovski, 2011). This is confirmed by Chinese scholars, e.g., "the existence of an energy system has not yet been scientifically demonstrated" (Liu, 2018). In the West, some authors have associated chakras with endocrine glands (Brennan, 1988) or with the nerve plexuses (Leadbeater, 1927). However, chakras are traditionally related to an energy field called chi in China or prana in India, essentially referring to the same concept. In the West, prana has also been called the "biological field," "bioenergy field," or "vital fluid." It should be noted that the chakra concept is not limited to Asia, but is known under different names and among various cultures elsewhere in the world.

According to tradition, the chakras are located partly inside and partly outside the body, emanating from it at specific locations, for example along the spinal cord or some meridians. As stated above, it is yet unclear whether the chakra energy interacts with our body and how. Many questions arise when considering the possibility of chakra existence: Is chakra energy supporting our body, or is it originating from our body, or is it a separate entity from our body? Is the chakra portion residing outside the body merely subjective or could it be demonstrated to be real? Are chakras purely symbolic or do they represent real entities, although non-physical ones?

The admitted non-physical, unknown, nature of the chakras raises the difficulty of interacting with them through any device to prove their existence (Maxwell, 2009): "The challenge for anyone interested in explaining chakras is to be able to demonstrate how something nonphysical could interact with the physical."

However, demonstrating the reality of the chakras may bring great advances in different fields, not only to yoga studies. A fairly exhaustive list of implications that would arise from validating the existence of the chakra energy field has already been given (Tiller, 1993). I will highlight a few items here.

Scientifically confirming the chakra's existence will change the way traditional Chinese and Indian medicine and practices are perceived in the West. It would indeed be a first step toward acknowledging the traditional claims around meridians and chakras.

From a spiritual point of view, the existence of chakras would fuel our questioning around the possibility of a conscious entity separated from the body. This would then lead us to the question of the survival of this energy field after death, i.e., of the immortality of the soul.

We can also imagine that the chakra radiating field could be a medium able to convey biological information. This could shed a light on memory of water and homeopathy issues. From a physics perspective, validating the existence of a new field such as the chakra field could have important implications, at a time when the unification of quantum mechanics and general relativity has not yet been achieved.

METHODOLOGICAL WEAKNESSES OF PAST APPROACHES

Many ways of assessing the chakra energy field have been used in the past. These fall into three main categories:

—direct or indirect measurements or observations attributed to chakras;

—theory-building that would account for observed facts or share similarities with these facts;

—testimonials collection.

The methods in the first category were explored by Motoyama (1981), Hunt (1996), and others (Curtis et al, 2004; Korotkov et al., 2009).

Motoyama built a recording booth electrically shielded from outside electromagnetic disturbances. He measured the body's electromagnetic field by placing a round electrode at a distance from the skin surface of the subject. He said that these measurements accounted for the chakra energy field and measured people claiming to be skilled at using and projecting chakra energy. But these experiments were based on the hypothesis that the measured electric field could be somewhat related to the chakras through the nervous systems of the subjects. However, no explanation was given as to why the sensor measurements could be related to chakra behavior. Moreover, no justification was provided as to why this specific measuring device would be more relevant than any other to record chakra data.

Hunt found that electrical activity changed at the locations of the chakras in synchronization with biofield energy progression through the body. She measured electrical activity with electromyography bipolar sensor electrodes attached to the skin at body points corresponding to chakra locations. During the experiment, an aura reader would describe the path followed by the biofield energy and its behavior. The reader described, e.g., which body zone was being entered and where the energy would stay longer. Both the reader descriptions and the electrical activity were recorded simultaneously. After the experiment, it became obvious to Hunt that electrical signals changes seen on the printer were time-correlated to the spaces crossed by the energy as recorded on tape and described by the aura reader.

Again, in this experiment no clear rationale is given to explain how the measured electrical activity could be related to chakra activity. We could imagine that what was being measured and seen by the aura reader could just be electrical phenomena in the body without requiring the additional hypothesis of the existence of chakras (Occam's razor principle).

Consequently, it appears from both experiments that some biological parameter variations are indeed being measured, but their authors don't demonstrate the relationship between these parameters and the activity of the chakras. So their results could be explained by electrical phenomena occurring in the body, as seen in electroencephalograms or electrocardiograms, thus without the need to acknowledge the existence of the chakras. Hence it appears that without knowing the intimate nature and the mode of operation of prana, we cannot determine which biological parameters should be related to chakra activity. In the same way, we have no indication of the sensitivity level which would be necessary to measure these parameters. As Motoyama cautiously wrote: "these observations suggest indirect scientific support for the existence of the chakras in that the activation and awakening of the chakras may have led to activation of the autonomic nerves and the organs that are supposedly connected with the chakras" (Motoyama, 1981).

It seems, therefore, if not vain, at least extremely delicate to try and gain access to the chakra's subtle energy by employing such indirect measurements (Liu, 2018).

It would therefore be premature to measure, with any kind of device, a phenomenon whose very nature and mode of action in its environment are still unknown. It would be a bit like trying to record colors with a microphone. Consequently, to my knowledge, no fully satisfactory scientific experiment has convincingly demonstrated the existence of chakras, and, even less, enabled us to define their nature.

In the same category of observed effects attributed to chakras, we find experiments dedicated to healing through the bioenergy field (Hunt, 1996; Liu, 2018). This kind of assessment suffers from the same weakness: How can we know that the healing process under scrutiny has a specific action on chakras? It is well-known that the placebo effect could account for observed pain relief (Jain & Mills, 2009). In such situations, the part played by chakras in the healing process is not clearly defined (Tsuchiya & Motoyama, 2009).

The second category of chakra assessment methods comprises such theoretical frameworks as, e.g., the one given by Shang and extended later by Maxwell (Shang, 2001; Maxwell, 2009). They propose to associate chakras with embryological organizing centers in the central nervous system. They state that gap junctions can be activated by brain mechanisms and then induce an impression close to the one felt by yoga practitioners. This theory tries to relate chakra sensations to physical structures inside our bodies: Willful concentration on points associated with chakras within the autonomous nervous system induces a change in activity in centers within the central nervous system (CNS), that could represent "the physical base of the chakras, the physical structure most immediately connected to subjectively perceived chakra activity." This theory thus suggests that chakras are not non-physical structures, really existing on their own, but rather that they are subjectively built in our mind when stimulating physical parts of our body. While this theory provides a possible way of explaining the belief in chakras, it suffers from being only an analogical reasoning that remains to be proved true. Until then, it is only a speculative theory.

The other pitfall of such theories is that they fall short of explaining some facts or experiments not yet fully understood: the alleged distant action of chakras as described by Motoyama (1981) or the fact that a chakra can be felt without requiring the subject to be fully concentrated on it. It thus appears that existing theories do not account for all empirically known facts. At the same time, a broader corpus of numerous, varied, and well-documented empirical facts is lacking to bring to light their commonalities and then to inspire future theories. It seems indeed difficult to develop further such theories before having a thorough description of chakra behavior in all sorts of conditions.

The third method to prove the existence of chakras could be to analyze various testimonials from, e.g., yoga or Qi Gong practitioners. However, there are many limitations to this approach:

—chakra perception may differ from one subject to another, for example, Motoyama (1981) did not agree with Leadbeater's account (Leadbeater, 1927) of the symbolic aspect of chakras. The difference observed between practitioners may also be explained by different sensory sensitivities: Some individuals, like the author, are more tactile whereas some others may be more visual.

—human testimonials are subjected to many potential drawbacks: the difficulty in expressing one's feelings, the prejudices and expectations coming from cultural representations, and the difficulty in obtaining reliable testimony (Loftus, 2003; West & Meterko, 2016).

From all these considerations, testimonials cannot be assigned an objective value and be considered scientific evidence of chakra existence. To this end, specific psychometric scales are yet to be designed and applied (Liu, 2018). Nevertheless, individual sensations could be used as an empirical knowledge base on which a scientific experiment may be designed, as was done in the past (Motoyama, 1981), or on which new theories could be built.

In conclusion, using measurement devices, elaborating a theory, or analyzing testimonials seem to be weak methods of chakra assessment, given the current state of our understanding of chakra subtle energy.

Hence, it appears crucial to follow a research program that would first establish the reality of chakra energy beyond any reasonable doubt, then compile a corpus of observed facts (behavior, interactions), and eventually link together these facts with a comprehensive theory. The main experiment proposal given in this paper logically focuses on the first step of this program, aiming at assessing the existence of the chakra energy field.

This thought experiment could be compared to the EPR one (Einstein et al, 1935) as far as the subtlety of the phenomenon and the practical difficulty are concerned. The EPR experiment was proposed at a time when the authors didn't believe in the nonlocality effects of quantum mechanics. Their thought experiment has taken 47 years to be converted into an actual experiment in a laboratory (Aspect et al., 1982). Important physical experiments have often been preceded by thorough theoretical work and discussions.

PRELIMINARY EXPERIMENTS AND CHAKRA ENERGY BEHAVIOR

Although prana cannot be directly measured or observed, it can be experienced (Liu, 2018).

Apart from the six or seven chakras acknowledged by the Hindu tradition, the Chinese have explored other, smaller, chakras known as acupuncture points connected together through various meridians. The Chinese also developed methods (such as Chi Gong) enabling one to emit chi energy from the hands (see Appendix A for more details). The chi emission is known today as "chi projection" in relation to martial arts, a term used in Shaolin Monks' demonstrations. In contrast to this, no such subtle energy emission methods—to the author's knowledge—were developed in India.

Hence, the main experiment detailed below is designed according to empirical knowledge acquired by the author through his and others' experiences with the hand chakras and some preliminary experimental results. The latter were done to look for a clear picture of chakra energy behavior. The experiments were performed on an individual scale or with one partner.

These experiments are based on the perception of the chakra energy coming out of the Lao Gong point located in the palm, also known as the 8th point of the pericardium meridian (PC8 or PE8) or the 8th point of the heart master meridian. This particular point has been chosen for these experiments because it has traditionally been associated with the projection of chakra subtle energy out of the body in Qi Gong practice and martial arts (Réquéna, 1989).

Experimental Descriptions

Various experiments have been performed to understand chi energy behavior. Their protocols are given below, along with the questions that arise from them:

Experiment 1: One Individual

1) Meditation, concentration, deep breathing: going into a state of "inner listening" (5 min);

2) This step may be skipped as it has proven to have adverse effects on chi sensation for some individuals:

Intense rubbing of the two palms one against the other in a back-and-forth movement along the direction of the fingers (1 min);

3) Separation of the hands with palms facing one another;

4) With the hands at a distance from one another, what is perceived when the hands come closer to each other, each making a rotational movement in the plane of its palm?;

5) If there is a perception of something during the preceding step: Move the hands away from each other while maintaining this rotational movement, and evaluate any change in perception;

Experiment 2: Two Individuals, A and B

1) Each individual, A and B, follow experiment 1;

2) When the perception of chi is felt by the two, bring the right palm of A closer to the left palm of B: palm A stays a few centimeters above palm B. While rotating the upper hand A around the lower one B, what sensations are felt by A and B? Are they the same?

Experiment 3: One Individual, Different Materials

1) The individual follows experiment 1;

2) Various boards made out of different materials are placed in between the two hands of the individual in such a way that the palms can't face each other anymore. We used boards such as: a glass window, a wood board, an aluminum Dibond plate, and an iPad 2.

3) The two hands, with the plate in between, are moved closer together and then farther apart from one another. Each hand stays at one side of the board, rotating or moving closer and farther away as in Experiment 1 to enable chi energy perception. Is chakra energy felt through some materials? If so, which materials allow the chakra energy to pass through?

Preliminary Experiments Results

From Experiment 1, the chakra energy behavior, as felt by the author, can be described as follows: The energy coming out of the PC8 point feels like a "pressure" exerting a force on the palms that pushes them farther apart. This perception is nearly the same as the one that would be felt if one repelling magnet was put at the center of each palm. Alternately, this perception can also be compared to the one given by a spring which would be inserted between the two hands, each palm being in contact with the opposite

base of the spring. As the hands are moved closer together, the chakra pressure is increased, whereas this pressure is decreased as the hands are moved farther away from each other.

The chakra pressure between the hands is felt with decreased intensity as the hands move farther away from each other, but pressure can still be felt at a distance, as much as 30 cm apart. That distance presumably varies with individuals. From this experiment, we know that it is difficult to infer the behavior of chi energy with distance as one cannot tell if the pressure intensity at a given time is related to the distance only or also to a change in the body condition over time.

From this protocol, we also see that chakra strength perception depends on the moment the experiment is being done: the longer the preceding meditation, the higher the felt intensity, and the better the health and shape of the subject, the higher the perceived intensity.

This experiment also showed that any contact between the two hands during the experiment is detrimental to the chakra energy perception.

Given the perception of a pressure arising between two hands, one might question the term "chakra energy," as what is felt is more like a force pushing the hands apart than an energy.

It remains to be explored whether there are other parameters influencing the variations of the emission or reception of the chakra field. In the same manner, work must be done to account for external versus internal, body-related influences on chakra field intensity. Nevertheless, not having this knowledge does not impede performance of the main experiment.

From Experiment 2, we can observe discrepancies in the perception of the biofield, as well as differences in the strength of the biofield, among individuals. There are also noticeable variations in the ability to emit or perceive chakra energy from one subject to another. From this experiment, it is confirmed that the perception of the biofield is disturbed when the hand of one individual touches the hand of the other, or when it is in contact with any other object.

From Experiment 3, we see that chakra pressure can be felt through the various boards used without any noticeable alteration: Neither a decrease in intensity nor an energy deviation from the straight line joining the two palms has been perceived. That leads to the conclusion that the chakra energy field cannot be of an electromagnetic nature, otherwise it would have been stopped by the metal plates. For the same reason, it cannot be a type of pressure wave, like a sound wave, which would have similarly been blocked by any material board. This biofield cannot be thermal, as it would have been stopped by wood and glass boards in this case.

This experiment demonstrates that chakra interaction with matter is very faint. This sheds new light on the difficulty of direct measurements of chakra energy with material devices. As the most common materials cannot directly interact with the chakra field, any device built with them would be useless. Any new device-building would require careful design, taking into account these findings by involving, e.g., organic transducers (Tiller, 1993) if relevant. The worst-case scenario would be that the chakra field is composed of known faintly interacting particles like neutrinos which would require a very large detector with dimensions in the tens of meters (Fukuda et al., 2003), not usable at the scale of chakra experiments.

Assumptions about the Biofield Derived from This Experiment and Design Consequences

By combining the above findings with a careful examination of the concepts conveyed by traditional South Asian texts concerning chi (see Appendix A for a summary of these concepts), one can postulate the following hypotheses:

Hypothesis 1: The chakra field called chi can emanate from the hands of some individuals, either naturally or gradually, through practices like yoga, Qi Gong, Zen meditation, etc. Exchanges outside the body (emission-reception) can be carried out using the PC8 point.

Hypothesis 2: Apart from a few rare individuals, the majority of practitioners of these disciplines take several years before being able to feel chi. This postulate is analogous to the one that would be admitted in any other sensory discipline. Indeed, disciplines such as enology or singing have a long and intensive learning curve after validating an initially proven capacity. It would therefore be illusory to search for the perception or emission of chi in average persons as they are scarcely able to perceive it and do not necessarily emit a powerful enough chi that could be detected.

Hypothesis 3: In the same way, it seems logical to postulate that skilled practitioners can be either chi emitters, receivers, or transceivers. We can indeed assume that the emission capacity relies on different abilities than the subtle sensory perception associated with reception, and, in some cases, that the two abilities may be present together.

Hypothesis 4: From the above experiment account, we might infer that the emission/perception of chi energy may weaken over time and distance for a given subject. This implies that participants in an experiment may need to apply a method to "regenerate" their transmitting/receiving capacity regularly (see Appendix A). It also implies that the distance between a chi transmitter and receiver should not be too great.

Hypothesis 5: From the above experiment account, it appears necessary to avoid any physical contact between the experimenters and any other object, otherwise this

perception will disappear. We can see here an analogy with quantum decoherence, in which a microscopic quantum property (entanglement) disappears when there is an interaction at a macroscopic scale (Bacciagaluppi, 2020).

Hypothesis 6: From the above experimental results, it can be inferred that chakra radiation can pass through the most common materials: wood, glass, and metal.

Hypothesis 7: The chakra field is different in nature from awareness. Its properties can be felt and located rather precisely in space, e.g., between two hands. If we encompass telepathy and other like phenomena in awareness, it would be logical to think that awareness is a non-local phenomena as opposed to chakras, which are always represented and felt at precise locations inside and outside the body. One thing they have in common, however, is that both awareness and chakras interact very faintly with matter.

All these hypotheses enable one to draw guidelines for the design of the main experiment:

—Hypothesis 2 allows us to define the conditions of the selection of persons to be included. Just as humans are not equal in terms of sensory perceptions (not everyone can become an outstanding oenologist, or a "nose" in the fragrance industry, etc.), there is no reason why we should all be equal in other areas of perception. The same goes for the ability to emit or perceive chakra energy.

—Hypothesis 3 allows us to define the role to be assigned to each person in the experiment to be conducted. In the context of an experimental protocol aimed at verifying the possibility of perceiving chi, it will be of interest to ideally associate a powerful emitter with a very sensitive receiver. The most unfavorable setup would be pairing a weak emitter with a very insensitive receiver.

—Hypothesis 4 allows us to define one of the stages of the experiment, namely the regeneration step, enabling chakra energy perception during the entire course of the experiment.

—Hypotheses 5 and 6 allow us to define the material building conditions of the experiment.

SELECTING THE BEST CHAKRA ENERGY EMITTERS AND RECEIVERS

As is known from any other sensory perception experiment, e.g., wine sensory perception (Yang & Lee, 2020), such studies must be performed with a trained or expert panel, with practice-based experience in the field. Schmidt employed the same selection process, i.e., testing the best-performing subjects during his study of the micro-psychokinetic influence on a random number generator (Schmidt, 1971). According to the methodologies used in these fields, a selection process comprising three successive steps has been established to ensure that the selected panel will have good perceptive and/or chi-emitting abilities:

1) Identify groups of people likely to have good chi-emitting or chi-perceiving abilities, through a relevant and regular practice (Zen, yoga, Qi Gong, Tai Chi Chuan, religious meditation, etc.) spanning many decades.

2) Within these groups, question the practitioners on their ability to emit/perceive chakra energy chi. Ask them to perform Experiment 1 described above and ask them to describe their sensations. Select the practitioners whose feelings can be used in the main experiment.

3) Meet these candidates and apply the test described in Appendix B.

The difference between the abilities to emit or perceive chakra energy can be explained by the awakened state of each participant: Subjects with awakened lower chakras are believed to be of the receiving type, while subjects with awakened higher chakras are associated with the emitting type (Motoyama, 1981). After performing this preliminary test, and if the result is conclusive, the candidate should then be labeled either a "good emitter" or a "good perceiver." Some could perform equally well in these two categories, and then be labeled both as "good emitter and perceiver."

During the third step mentioned above, it is necessary to define a benchmark to which the first candidates will be compared. The author will serve as a reference for the first instance, changing this standard to the best candidates in both categories as the panel size increases.

MAIN EXPERIMENTAL PROTOCOL

Experimental Setup

Through completing the previous selection process, it is assumed that at least two participants were selected for the main experiment. One has been labeled "best chakra energy emitter" among the emitters' panel while the other has been labeled "best chakra energy perceiver" among the perceivers' panel.

These two practitioners are placed in two separate and insulated booths so that no information of any (known) nature can be transmitted from one booth to the other: sound, vibration, and electromagnetic (Faraday) insulation are provided. Each one of these rooms hosts one person. The two participants are separated from one another by a laminate wall. In this wall, 5 "interaction zones" are defined (Figure 1). Each interaction zone is made of several layers, parallel to the wall surface: a glass plate facing booth 1 (for thermal insulation), a white sheet of paper marked with a symbol and facing booth 1 if the perceiver is there, a metal plate (electromagnetic insulation), a white paper sheet

marked with a symbol and facing booth 2 if the perceiver is there, a glass plate facing booth 2 (Figure 2). Each glass plate is properly sealed to the flat interface wall (e.g., with a silicone seal) so that no light can be seen from the other side. Each interaction area must be wider and higher than one hand to avoid any possible confusion. The general layout of the experiment is shown in Figure 3.

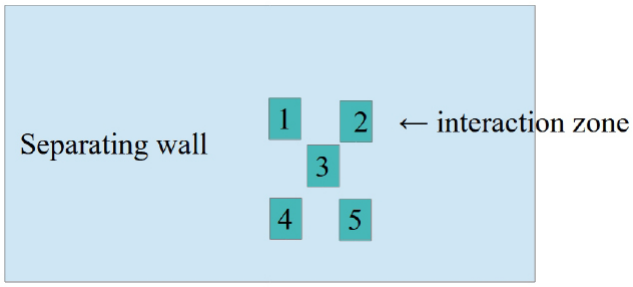

Figure 1. Wall separating the two participants seen from the front side.

Figure 2. Side view of the separating wall at one of the 5 "interaction zones." Glass (green), paper sheet facing either the left or right side (hatched white), metal wall (black), and glass (green). A thermal insulating layer may be added if necessary.

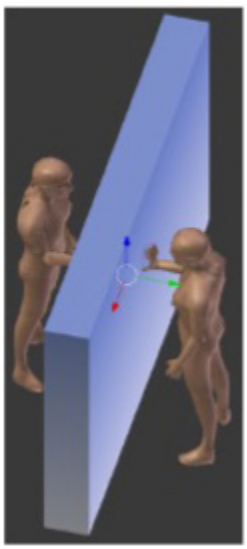

Figure 3. Location of the two participants on either side of the separating wall.

Eight cameras temporally synchronized with each other film the booths, that is four cameras per booth. In order to avoid any blind spots, these cameras must be located as follows:

—a first camera attached to the ceiling grabs the experiment from above;

—a second camera attached to the wall to the right side of the participant grabs the experiment as seen from the right side of the booth;

—a third camera attached to the wall to the left side of the participant grabs the experiment as seen from the left side of the booth;

—a fourth camera attached to the rear wall a few meters behind the participant's back grabs the experiment as seen from the back of the participant;

The 4 cameras visualizing a booth must be strictly identical. The synchronization process is done by automated electronic means like sharing a time code, using an electronic trigger, or by having a light source flashing a Gray code.

The cameras must have a resolution high enough to be able to identify and grab:

—the symbol corresponding to the LED randomly lit up on the emitter side;

—the location of the hand of the emitter when it is put in front of the interaction zone;

—the location of the receiver's hand in front of the perceived interaction zone;

Other measuring means can be included to monitor sound or vibrations in both booths (broad-spectrum analyzers, radio frequencies analyzer, etc.). Thermal cameras can also be added to both booths to ensure no thermal bridge connects one booth to the other.

Additionally, the hands or whole bodies of the participants could be imaged (X-rayed, terahertz, thermal, visible, or else) before and after the experiment to detect any possible change or bias that may have occurred.

Finally, insulation of the participants from vibrations transmitted through the ground must be provided, either by applying a special absorbing material or layers of different materials between the participants and the ground or by splitting the ground into two mechanically independent parts, or by applying both methods.

Experimental Procedure

To ensure objectivity and uniform randomness for this experiment, the whole protocol is monitored by a computer. This computer hosts a program whose source code could be published.

Each individual detection test is performed in the following way:

—The algorithm hosted in the computer randomly chooses an interaction zone number;

—The computer lights up the LED located above the interaction zone previously chosen;

—Participant E (Emitter) is then asked to put his hand over the interaction zone indicated by the lit-up LED. Note: the light from the indicating LED must not be perceived from the other booth. When E is ready, a signal is given to inform the computer, either vocally or by any other means.

—Participant R (perceiver) is then asked by the computer to try and determine which interaction zone is located in front of E's hand. To perform this task, R scans each possible interaction zone at will. When the correct zone is thought to have been detected, R pushes a button corresponding to the identified zone. Neither E nor R must touch the separating wall during the process nor communicate by any means.

A pause enables the participants to concentrate, meditate, or rub their hands to regenerate their sensitivity.

The computer repeats 16 times this individual detection test through LED indications of randomly chosen interaction zones. A series of 16 symbols is then built this way, corresponding to the symbols on the white sheets located at the interaction zones that had been randomly chosen.

The whole experiment will be automatically driven by a computer without the need for any human intervention. Using, e.g., an image-processing algorithm or ultrasonic range-detection sensors, the monitoring computer will be able to record the result of each individual detection test, thus providing a final score at the end of the whole experiment and indicating the statistical relevance of the final overall result. This fully automated experiment ensures that no human intervention is required from either the participants or the researchers, thus making this study a double-blind experiment.

The experiment will be supervised by experimenters recognized as agnostics toward the subtle energy concept. Their degree of agnosticism could be measured, e.g., on a Likert Scale. The full automation of the experiment and the measure of the degree of agnosticism will ensure that the experimenter effect is avoided.

The test will be considered conclusive when the hands are face-to-face, with an offset to be defined, not exceeding the size of an interaction zone, as shown in Figure 4. The test will fail if the hands are offset by a distance greater than a predefined threshold, as shown in Figure 5.

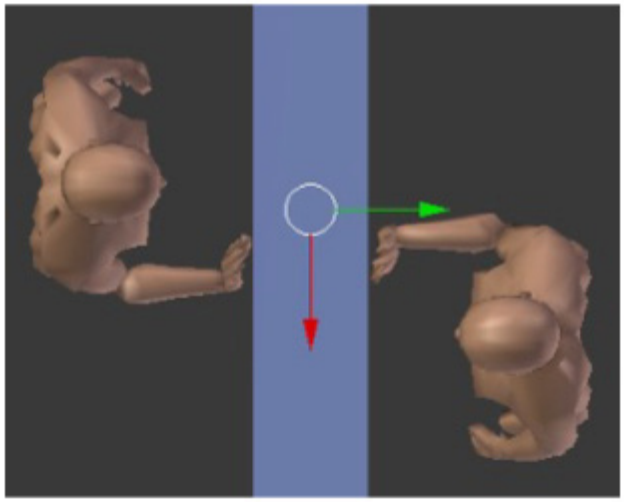

Figure 4. Hands facing each other, conclusive test.

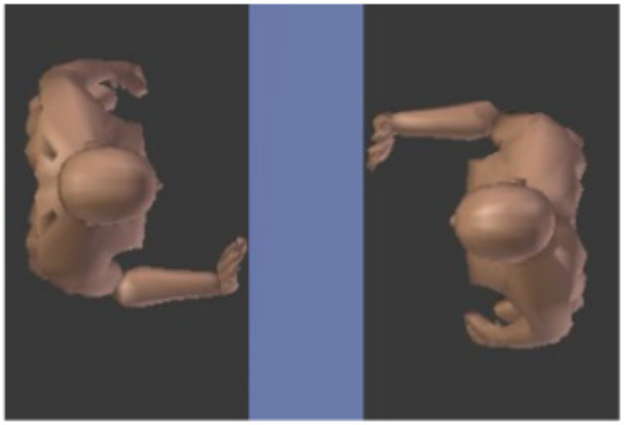

Figure 5. Hands too far apart, inconclusive test.

Duration Estimation

We can estimate the total time span of the experiment with the following, e.g., duration hypotheses:

— 2 min for E to put the hand over the required symbol and be ready;

— 1 min of scanning per symbol for R, followed by 1 min of regeneration, and this 5 times for each scan, i.e., 2 x 5 = 10 min per scan;

— 3 min of relaxation between individual tests.

Under these assumptions, the time duration would be 15 min per individual test. For a total of 16 tests this amounts to 15 x 16 min = 240 min = 4 h. Taking into account necessary body movements and physiological needs, the duration of the total experiment can be estimated to be around 4 h 30 m. To experiment in the best conditions, e.g., to avoid a drop in the emitting or perceiving ability, it would be advisable to discuss the preferred schedule with the subjects.

Statistical Analysis of the Main Experiment

The experimental design satisfies the conditions of a Bernoulli experiment, where N = 16 is the total number of trials and p = 0.2 is the probability of success for each trial. The expected number of correct answers if the receiver is randomly guessing is then, according to binomial law: E(X) = 16 x 0.2 = 3.2. The expected results according to the binomial law are given in Table 1 below:

TABLE 1. Success Probabilities for the Main Experiment

A	B	C
Number of K Successes:	Probability of obtaining exactly this number of successes P(X=k):	P(X<=k):
0	1,24E-003	1,238E-003
1	9,28E-003	1,052E-002
2	3,37E-002	4,418E-002
3	7,85E-002	1,227E-001
4	1,33E-001	2,552E-001
5	1,72E-001	4,275E-001
6	1,79E-001	6,070E-001
7	1,54E-001	7,608E-001
8	1,11E-001	8,713E-001
9	6,76E-002	9,389E-001
10	**3,55E-002**	**9,744E-001**
11	1,61E-002	9,905E-001
12	6,38E-003	9,969E-001
13	2,21E-003	9,991E-001
14	6,71E-004	9,998E-001
15	1,79E-004	9,999E-001
16	4,19E-005	1,000E+000

The null hypothesis H_0 in this statistical analysis can be stated as: "Test results are obtained by mere guesses," while the H_1 hypothesis is then: "Test results are explained by the genuine detection of chakra energy through the wall." For a sample size of N = 16 detection tests, Table 1 shows in bold font the minimal number of successes to reject H_0 at the standard significance level of 95%. Hence, if 10 or more detection tests succeed out of 16, we reject H_0 and can assume H_1 is true, that is, the chakra energy field has indeed been detected through the wall.

CONCLUSION

The attempts at demonstrating chakra energy existence suffered in the past from various weaknesses. After having performed preliminary experiments on himself and others, the author has identified some chakra energy behaviors that have been used to design the main experiment described here. This experimental protocol addresses the drawbacks of past experiments by ensuring objectivity and specificity. Objectivity is reached by the double-blind nature of the experiment. Indeed, all the monitoring, controlling, and collecting of the results, including the resulting statistical analysis of the data, are done by a computer in a fully automated way. Specificity is ensured both by unambiguous sensing of the chakra energy field and by insulation from all other types of energy disturbances (thermal, electromagnetic, mechanical, etc.).

Two main tasks have to be carefully completed to properly build this experiment: the selection of a panel of skilled subjects and the technical developments required for trial automation. The experiment proposed here could be further extended by testing two groups: one with skilled people and another one with people who have never practiced chi techniques.

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APPENDIX A: TRADITIONAL CONCEPTS ON CHI/PRANA

According to Chinese tradition (Réquéna, 1989), methods such as meditation and breath control allow the accumulation of chi in an "energy tank" called the lower dantian. This corresponds to the hara referred to in the Japanese tradition. The practitioners thus "refill" their chi tank as if they were batteries. Any discharge of chi during an experiment requires, therefore, an equivalent refill of this tank to ensure a constant level of chi.

To illustrate this, Réquéna wrote: "To fill one's dantian completely requires 81 hours of deep meditation," and "If he meditates daily, at the rate of one hour, it will take him about ten years to fill his dantian." These figures seem to be overly precise. They can be taken as an order of magnitude, the time necessary to enter into deep meditation, depending on each practitioner.

Traditionally, chi is considered as a flow of energy that can enter and leave the body at different points: "Another type of qi is external qi, which can be emitted from the body by some individuals, such as Qigong practitioners" (Liu, 2018). Thus, before attempting to emit chi, it is necessary to know its points of emission (Motoyama, 1981). The emission of chi requires the subject to be concentrated on a specific meridian, depending on the desired location of the point of emission. Thus, an emission by the palm area corresponds for example to the eighth point of the meridian of the pericardium meridian or heart master, called "lao gong" (PE8) (Figure A.1). The practitioner wishing to emit chi at this point will therefore mainly focus his attention on this meridian. Unlike meditation, which can aim to fill or refill the chi tank, and which is essentially a state of mind of "emptiness," the training toward chi emission necessitates focusing one's attention.

As far as the perception of chi is concerned, it is mainly associated with the development of the subtle sense of touch, in the case of tactile sensitivity. More precisely, in

Figure A.1. Part of the meridian system in the hand. (Meridian System, 2010)

the Samkhya philosophy, the subtle senses of perception are called Jnanendriya. For example, the Jnanendriya corresponding to the sense of subtle touch is called: "tvak." The development of a subtle sense of perception is specific to each person: Not all of us can develop such a sense to the same degree of sensitivity as other people. There is therefore for each person a hierarchy of subtle senses in the same way that there is also such a hierarchy for our five physical senses.

APPENDIX B: PANEL TEST SELECTION

The candidate selection test goes through the following steps:

1) Meditation, concentration, deep breathing: putting oneself into a state of "inner listening" and mental emptiness;

2) Intense rubbing of the two parallel palms of the same person in a back-and-forth movement along the axis of the fingers;

3) Separation of the hands when they are face-toface;

4) Attempt to perceive first of all with the hands close to each other, each making a rotational movement in the plane of the palm;

5) If there is perception at this stage (feeling of a "pressure" exerted upon the palm): Move the hands away from each other while maintaining this rotational movement to confirm if the perception is still present at a greater distance;

6) When the pressure is still felt distantly, bring the right palm (A) closer to the left palm (B) of a second person who has followed the same preceding procedure: Stay a few cm above this palm B.

7) At this stage of the test, participant B may be prevented from looking at the hands, or this part of the test may be performed in an opaque enclosure. With palms A and B parallel to each other, apply a movement with palm A relatively to palm B, while palm B remains still. Ask B if a variation is felt. Note if the variation felt by B agrees with the palm A movement.