

Commentary

Philosophy, Psychology, Physics and Practice of *Ki*

S. Tsuyoshi Ohnishi¹ and Tomoko Ohnishi²

¹Philadelphia Biomedical Research Institute, King of Prussia, PA 19406 and ²Department of Biochemistry and Biophysics, University of Pennsylvania School of Medicine, Philadelphia, PA 19104, USA

Ki (in Japanese) or *Qi* (in Chinese) is the key concept in Eastern medicine, Eastern philosophy, as well as in martial arts. We explain the philosophical and psychological background of *Ki*. We emphasize that the unique aspects of Eastern philosophy are ‘non-linearity’ and ‘holistic’ approach. We then present physics aspect of *Ki*. Our experiments demonstrated that a ‘*Ki*-beam’ carries ‘entropy’ (or information), which is different from ‘energy’. We introduce our experience of having taught *Ki* to 37 beginners in the United States through the Nishino Breathing Method. If beginners had martial arts training or a strong background in music or dance, about half of them could sense *Ki* within 10 weeks (1 h class per week) of practice.

Keywords: collective unconsciousness – Eastern medicine – *Ki* energy – *Ki* entropy – martial arts – Nishino Breathing Method – *Qi* – *Ki* information – Taiki practice – Toh-ate technique

Introduction

A Japanese word *Ki* (equivalent to *Qi* or *Chi* in Chinese) is the fundamental concept in both Eastern medicine and martial arts (1–3). It naturally follows that *Ki* is an important element in complementary and alternative medicine (CAM). Many authors have presented work on the effects and nature of *Ki* (4–15). Still, we can not precisely describe *Ki*. We cannot objectively say ‘Look! This is *Ki*’.

When Western people talk about *Ki* in terms of the healing arts, *Ki* seems to be understood as ‘vitality’ or ‘life-energy’. For those who are studying Chinese medicine, *Ki* is presented as being a substance flowing in our body along the ‘meridians’. In the view of martial artists, *Ki* is a source of spiritual strength for winning. When an Eastern philosopher defines *Ki*, it is a function of life, which permeates through the life of an individual and the life of the universe. Physicists see it as a new kind of ‘energy’, and still, brain physiologists approach it as

‘information’ or ‘entropy’. Depending upon one’s profession, discipline and necessity, *Ki* is understood differently.

Both of us were born in Japan and were raised in families where the concept of *Ki* was not foreign to our ways of thinking. In 1963, one of the authors (S.T.O.) started learning Aikido in Japan from Master Morihei Ueshiba (the founder of Aikido) and Kisshomaru Ueshiba (the founder’s son), as well as from Koichi Tohei and Morihiro Saito (both were Ueshiba’s immediate disciples). From 1967–97, S.T.O. taught Aikido in the USA. From 1997, both authors started learning the Nishino Breathing Method (NBM) by visiting the school in Japan where Master Kozo Nishino (the founder) teaches. In 2006, both authors started teaching NBM in the USA.

Nishino was once a medical student, but became a ballet choreographer after he studied ballet at the Metropolitan Opera Ballet School in New York. At the age of 50, he started learning Aikido and quickly became a master of Aikido. He then founded NBM as a method of raising his student’s *Ki* levels so that they could enjoy life to its fullest (16–18). It has been known for the past 20 years that the practitioners of *Ki* experienced beneficial health effects (16, 19–24). Through our collaborative study with Nishino using *in vitro* biological

For reprints and all correspondence: S. Tsuyoshi Ohnishi, Philadelphia Biomedical Research Institute, Suite 250, 100 Ross Road, King of Prussia, PA 19406-0227. Tel: +1-610-688-6276; Fax: +1-610-254-9332; E-mail: stohnishi@aol.com

systems, it was suggested that *Ki* developed by NBM may indeed have health benefit (25–27).

In this commentary, we will first discuss historical, philosophical and psychological aspects of *Ki* in Eastern medicine and martial arts. Then, we will switch the subject to a more practical question, ‘How quickly we can learn *Ki*?’ Finally, we will introduce new methods of testing the *Ki*-level of an individual. We will also present an experimental method, which demonstrates that an ‘information’ aspect (‘entropy’ aspect) is involved in *Ki*. We believe that this aspect of *Ki* is very important from the standpoint of CAM.

Difference between Western Medicine and Traditional Eastern Medicine

Eastern medicine has been built on the fundamental concept that the head and the various inner organs are connected to specific points in distal areas (i.e. hands and legs) with ‘meridians’. The major meridians are 12 regular meridians and eight irregular meridians. They are broadly divided into *yin* and *yang* groups and *Ki* flows through them. Along these meridians, there are about 350 acupoints, which are used for acupuncture therapy. When the *Ki*-flow is stagnant, we become sick. Acupuncture allows the *Ki* to flow smoothly. At the terminal acupoint of each meridian in distal areas, it is believed that an exchange of *Ki* between the external world and the internal body occurs. In other words, Eastern medicine understands the body as an ‘open system’ connected to the external world. On the contrary, modern Western medicine regards our body as a ‘closed, self-contained system’ (2,3). The concept of our body being an ‘open system’ would help us to understand why *Ki* would have a healing effect. A healer, who emits *Ki* toward an acupoint on the skin, may be able to enhance or normalize the *Ki*-flow inside the patient’s body.

Understanding of *Ki* will Help Bridge Western and Eastern Viewpoints

As we described previously (28–30), Western thinking was built upon three fundamental pillars, namely, Greek reductionism, separation of mind and matter (which led to the separation of mind and body) advocated by Descartes (1596–50), and a deterministic-monotheistic worldview originated by Newton (1642–1727). All of these pillars belong to a ‘linear’ philosophical system in which the future is predictable. A serious problem is that both life and the universe are essentially ‘non-linear’ systems, and therefore, the future becomes ‘chaos’ and it is essentially unpredictable (30). Many of today’s problems are created because everyone tries to understand the non-linear ‘unpredictable’ universe based upon linear ‘predictable’ thinking. In order to accept that the future is essentially unpredictable, a Copernican change

of our philosophy is needed. The understanding of *Ki*, which is non-linear (30) and involves ‘unpredictability’, would help this transition.

By separating matter from mind, material science was able to undergo vigorous development without the hindrance of medieval mysticism. However, this has carried to the extreme. This has led to the loss of humanism in the last century. Today, materialism has superseded reverence of the mind and even the dignity of human life. To reverse this devastating situation, we have to overcome the dichotomy of ‘either-or’ thinking. Therefore, the more holistic, ‘non-linear’ Eastern approach considering the ‘Oneness of mind and body’ is even more relevant today.

Another urgent issue is the destruction of the ecosystem. In the West, it was taught that human beings appeared first on earth, and plants, trees, animals appeared later for the benefit of the human race. This, together with an endless pursuit of material happiness and fulfillment of desire, has caused today’s ecological problems. Contrary to this, it is a common belief in the East that life is created from its environment, and naturally, life and the environment are inseparable. This is in perfect agreement with the results of scientific research. It is known that ‘planet’ earth was born about 5 billion years ago, and a primitive ‘life form’ appeared about 4 billion years ago in the sea. The ‘life form’ developed in the sea, and about 400 million years ago it started spreading on land because there accumulated enough amount of ozone in the atmosphere to provide shielding from harmful ultraviolet radiation. The ape-man appeared several million years ago, and finally *Homo sapiens*, our ancestors, appeared approximately 35 000 years ago. Civilization began about 10 000 years ago, and modern civilization started only 200 years ago—like a blink of an eye compared with the unfathomably long history of evolution. However, modern civilization is destroying the harmony of the ecosystem, which has 4 billion years of history.

According to Eastern thought, the universe has ‘life’ and the function of ‘life’ is represented by *Ki*. *Ki* flows and circulates throughout the universe and through each human being. *Ki* is a non-linear phenomenon (30), and therefore, it can function as an essential element of life and the universe (both of which are non-linear). If Western people could understand *Ki* more, they would incorporate holistic Eastern philosophy into their own philosophical system. Then, mind and body, as well as life and its environment, will be viewed as a unified entity, and the world would finally become a better place to live.

Difference of Philosophical Backgrounds between *Qi* and *Ki*

In 1972, from the excavation of an ancient tomb in China (believed to be about 2000 years old), 44 pictures of poses

related to what we call today *Qigong* were found (1). The first Chinese literature, which described the effect of *Qigong*, was inscribed on an ancient sword handle (which was believed to be about 2500 years old). The origin of the character of *Qi* was traced back to 3500 years ago (1).

Confucius (who lived approximately 2500 years ago), taught moral and ethical behavior. In his Analects, the character of *Qi* appeared in four locations. It expressed the concept related to breath, food and vitality (1). Taoism, which was founded by Lao-Tze (who was believed to have lived around the time of Confucius or 100 later), have had more influence on *Qi* and *Qigong*. In the book 'Zhuangzi', which compiled the thoughts of Lao-Tze in the third century BC, the character of *Qi* appeared 39 times. What it explained was: '*Qi* exists throughout the universe. When it assembles, it appears as a human life. When it disassembles, the human dies. Therefore, do not worry about life and death. Live naturally and freely as you are' (1). The concepts of *Qi*, *Yin/Yang* and meridians formed the foundation of Chinese medicine. Martial artists have also studied these concepts. They knew how to attack vital acupoints to kill an opponent or how to revive a victim.

In Japan, *Ki* was used for healing from around 1500 years ago. Toward the end of Heian Period (about 800 years ago), Samurai warriors held political power, and continued to do so for 700 years. During that time, the upper class of Samurai devoted themselves to self-cultivation by practicing Zen and Esoteric Buddhism. As a result, the martial arts were not simply combat techniques, but acquired a high artistic sensitivity and spirituality. They trained themselves to enhance *Ki* through meditation and breathing. The origin for this could be found in a book called *Makashikan* (Chinese: *Mohezhiqun*), which was lectured by Chih-i (a Chinese Buddhist monk; 538–597 AD). He talked about self-cultivation methods and Buddhist medicine. He explained two cultivation methods, namely, 'meditation with prolonged sitting' and 'meditation with prolonged walking' (3). The former practice became the foundation for Zen, and the latter for Esoteric Buddhism.

Chih-i also explained a method of meditation, which could enhance our health. One of his methods was to imagine that a piece of excellent food (such as a delicious cheese) is sitting on one's head. Then, imagine that the food melts and penetrates the skin and goes down through the head and body, thus cleaning up the whole system. Interestingly, a similar exercise is used in NBM.

As opposed to Chinese *Qi*, which grew under the influence of Taoism, Japanese *Ki* was heavily influenced by Buddhism. The *Heiho Kadensho* (The Secret Text Book of the Military Method, which had been perpetuated through the Yagyu School of martial arts. The Yagyu family taught martial arts to the Shogun, the highest post in the Samurai government) described that the human mind is distinguished into an 'original mind'

(enlightened nature or Buddha nature) and a 'deluded mind (easily agitated by egocentric feeling and emotion). The original goal of the Samurai way was the development of a mature personality, which would not be influenced by the deluded mind, through discipline and through enhancing *Ki* (3).

However, the ultimate purpose of martial arts was changed in modern times from killing others to self-defence and conquering oneself. Aikido was created in this atmosphere. *Ai* means harmony. It also means love. Therefore, the ultimate goal of Aikido is to harmonize *Ki* with the opponent's body-mind movement. Ueshiba, the founder, declared that the secret of Aikido is to harmonize one's movement with the universe. In other words, it is to understand that 'I am one with the universe'. The Japanese Samurai way and Buddhist teachings had a profound influence over Japanese culture and intellectual history.

Secret Technique of *Ki* in Martial Arts

Stories tell us that the great martial artist possessed such a strong *Ki*-power that his opponents were immobilized. In Japanese martial arts' history, there were records that some martial artists could throw opponents without touching. This is known as the 'Toh-Ate' technique (literally, hit from a distance), and is considered to be the ultimate form of martial arts. However, this has been a secret technique for centuries and no curriculum to master this technique was taught or published until recently. Currently, at least three Japanese *Ki* masters (Kozo Nishino, Hiroyuki Aoki and Kojo Tsuboi) are reported to be able to perform the 'Toh-Ate' technique (1). It is interesting to note that two of them (Nishino and Tsuboi) had practiced Aikido. Aoki was an expert in Karate. Japanese brain physiologists recorded changes in the brain wave of Aoki when he performed Toh-Ate technique (31,32).

Difference between Sports and Martial Arts

Yuasa pointed out that until recently the training emphasis for modern Western sports was to develop the body's motor skills and muscles capacity. (That is why some athletes use illegal muscle-developing drugs). On the other hand, the Japanese Samurai way (the Bushi way or Bushi-do) was designed with the goal of strengthening the synthesis between consciousness and unconsciousness by controlling unconscious emotional functions (3). Western sports' training is now also embracing these concepts. Now, we have to study the relationship between *Ki* and psychology.

Ki and Collective Unconsciousness of Jung

The practice of the Japanese Samurai way is linked to overcoming problems arising from one's unconscious

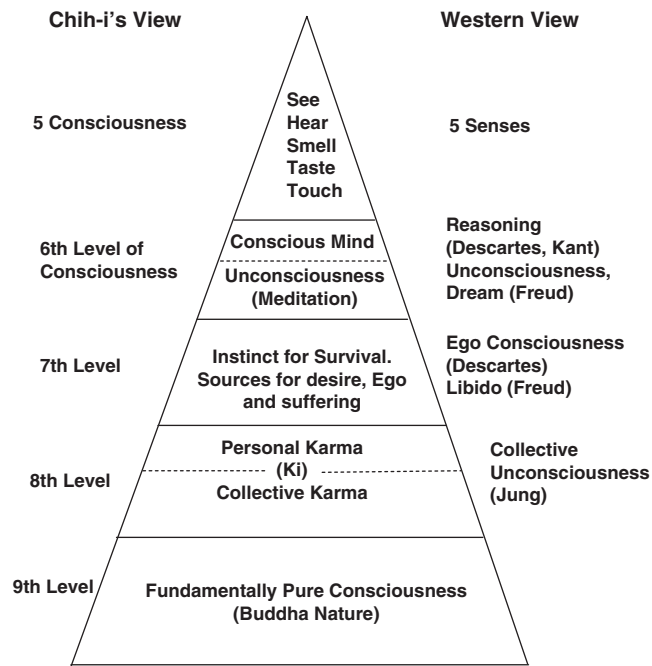


Figure 1. Schematic presentation of the nine levels of consciousness as described by Chih-i. Explanations on the left are from Buddhist teachings. Those on the right are from Western philosophy, psychology and physiology.

state of mind (exemplified by Freudian psychology). This may be explained by a layered structure of different consciousness as presented by Chih-i. In Fig. 1, the Buddhist concepts are shown on the left side and the Western concepts are on the right. The concepts in five top layers (five levels of consciousness) are called eye, ear, nose, tongue or touch consciousness. Through these sensory organs, human beings perceive outer world. These functions correspond to the five senses in Western psychology, physiology and philosophy. In Buddhism, the sixth level of consciousness corresponds to our mind. It builds up images based upon five consciousnesses, and consciously understands the external world. This is similar to the theory of Kant (1724–1804) on cognition. A Buddhist scholar had built a theory similar to that of Kant 1200 years before. In Descartes' philosophy, human has a 'reasoning mind', which corresponds to the upper half of the sixth level. Unconsciousness proposed by Freud (1856–1939) corresponds to the lower half. The unconsciousness is believed to be the source of creativity and inspiration. Some Western people are interested in Zen meditation because they think that one may communicate with one's unconsciousness through meditation. However, as Chih-i taught, both 'meditation with prolonged sitting' and 'meditation with prolonged walking' are needed for self-cultivation. Zen uses only 'meditation with prolonged sitting' and that may not be enough. The 'meditation with prolonged walking' is also needed. 'Prolonged walking' does not

necessarily mean simple walking. It may also imply a regular physical exercise combined with mental training. In this regard, it is interesting to note that a Zen scholar (who later became the Head Priest of a Japanese Zen temple) wrote that his practice of NBM (which is a physical exercise with *Ki*) helped him to understand and master Zen (19).

The seventh level is a fundamental egocentric consciousness, which is related to human desire and instinct for survival. Descartes' 'ego-consciousness' can be included in this layer. Freudian 'Libido' also resides in this level. All of earthly desires, emotions and sufferings originate from here.

The eighth level of consciousness is considered to be a storage house of all actions, deeds, words and emotions of each individual created not only during this life time, but also in one's past lives (note: Buddhism considers that one's life continues eternally). In other words, this level is the store house of 'karma' (or destiny) of an individual (upper half) and the entire race (lower half).

While Freudian unconsciousness is related to personal experience after birth (especially that of the infant period), collective unconsciousness proposed by Jung (1875–1961) includes the experiences of all human beings from the remote past (in terms of time), and the experiences of everybody in the world (in terms of space) (33). Therefore, the eighth level of consciousness corresponds to collective unconsciousness. Then, a question may be raised: 'How can an individual relate to the life of others?' We believe this is where *Ki* can come in. At the school of NBM, we see everyday that the state of mind of an individual (in this case, Master Nishino) can influence not only the behavior and mind of a student with whom Nishino is directly practicing, but also the minds of everyone in the class room. *Ki* emitted from Nishino spreads through the air, and is received by everybody.

The manner in which each individual responds to Nishino's *Ki* is different. The life tendency or personality, which is normally hidden deep inside, suddenly appears when he or she receives *Ki* from Nishino. In other words, one's deepest essence of life (or personal karma) seems to appear instantly. Not only that, if everybody has the sensitivity to receive and send *Ki*, then, we all inherit the ability of *Ki*. This makes *Ki* the collective karma of the human being. We already pointed out that the practice of NBM may instantly bring the individual to the 'collective unconsciousness' (29).

The ninth level is called 'Fundamentally pure consciousness'. This can be regarded as the highest level of life (in which life of the humans is one with the life of the universe) or 'Buddha Nature'. This can eradicate all of the deluded illusions of our mind, and change the karma of the individual and the karma of the entire human race. This was explained in the Heiho Kadensho of the Yagyū School of martial arts. Chih-i believed that the Buddha nature exemplified in the Lotus Sutra represents this

ninth level. Western philosophy or psychology did not reach to the depth of ninth level of consciousness as the Eastern philosophic counterpart did. Our idea that *Ki* belongs to the eighth level is derived from these Eastern ways of thinking. In the East, it is believed that *Ki* is a function of life, which permeates through both an individual and the entire universe. Therefore, *Ki* must be very close to the ninth level.

Physics of *Ki*

Since both of us have studied biophysics for 40 some years, we have been interested in the nature of *Ki*. We recently published a physics-oriented hypothesis that *Ki* emission may be 'laser-like' near infrared radiation (NIR) from the practitioner's finger or hand (34). Several scientists asked us many questions, for example, 'Have you measured the strength of the *Ki*-signal?'; 'Can you simulate the *Ki*-effect by NIR emitted from an artificial source?'; 'If you think that *Ki* has an information, you must analyze the *Ki*-signal to determine what kind of information is included'; 'Unless you perform these quantitative measurements of *Ki*-energy or *Ki*-information, you cannot proceed to build a theory' and 'My idea is that *Ki* is an entirely new type of energy'. That is perfectly true. We agree with all of these points. An ideal scientific approach calls for many repeated observations. If they are repeatable and reproducible, then we build a theory.

However, in the study of *Ki*, we encountered two difficult problems. Namely, (i) *Ki* is manifested by only special people and (ii) we still cannot measure *Ki*-signals reproducibly with any of our instruments. Although there are interesting claims that '*Ki*-signals have been detected' or '*Ki* is an infrared radiation', but the '*Ki*-signals' from Qigong healers took a long time (at least the order of minute) to grow to its full strength (3,32,35–38). On the other hand, Aoki's Toh-ate or Nishino's 'Taiki' can move the opponent almost instantly. Therefore, we decided to uncover the secret of *Ki*, which enables Toh-ate or Taiki technique (29). What we did was to practice *Ki* at the school of NBM first. After, we advanced and started to emit *Ki* ourselves, we studied what our *Ki* could do to 'sensitive' students. In other words, since we could not catch *Ki* with instrumentation, we used 'sensitive students' as 'instruments' to measure the *Ki*-strength. Then, based upon those results, we built our hypothesis (34). This was only possible when both the *Ki*-emitter and the *Ki*-receiver practiced NBM. Interestingly, this is related to a difference between the Western and Eastern way of thinking. Let us now explain this point.

Another Difference between the West and the East: Theory and Practice

According to Yuasa (3,39), Western 'mind and body' theories have a strongly-held attitude of asking

theoretically what 'is' the relationship between the mind and body. On the other hand, Eastern theories take the attitude of asking how the mind and body relationship 'develops' or 'changes' through training and practice. Then, based on how the relationship has developed through practice, the theory asks in turn what is the 'original' relationship between mind and body?

Regarding this, Kasulis, the editor of Yuasa's book (39), pointed out that Eastern philosophies generally treat mind-body unity as an 'achievement', rather than an 'essential unchanging link'. He summarized as follows:

- (i) In Eastern culture, meditation and breathing are important practices in obtaining philosophical insight. Wisdom must be physically as well as intellectually developed.
- (ii) If the unity of mind and body is achieved, this can be tested by 'deeds'. In other words, whether a person attained enlightenment or not should be verified by 'action' rather than by 'asserted propositions'.
- (iii) Eastern philosophers do not agree with the Western tradition of dichotomies such as body-mind, subjectivity-objectivity and theory-praxis. Eastern people are not doing 'meta-physics' in the traditional Western sense. Instead, what they are doing is, what Jung called 'meta-psychics'. (Actually, Yuasa said that it can be called 'meta-human science'.)

These discussions clearly pointed out why dedicated, continuous practice is important to master any of these Eastern arts. Be it for Eastern medicine, *Qigong*, martial arts, *Ki*-related exercise or breathing, we can reach better understanding only after assiduous practice. By simply discussing them from theoretical point of view or based upon own ideas, we can never grasp the true picture of these arts. For this reason, we would like to touch upon our recent practice of teaching *Ki* to beginners in the USA.

How Quickly can a Beginner Sense *Ki*?

If *Ki* could enhance our vitality and improve health, then an important question would be: 'How quickly can we learn *Ki* and utilize it to improve our health?' Since we have taught NBM to 37 students in the USA from 2006, we undertook a survey of how quickly beginners can sense *Ki* by attending the class. We taught so far the following three courses:

- (i) Private Sunday Course: this is an hour class on every Sunday for those who want quickly to have a brief experience with NBM. We used the basement of our house for the class.
- (ii) Two Evening courses of '*Ki*-energy and NBM': we taught two courses, which were supported by the Main Line School Night (an adult education

program; we will abbreviate as MLSN), which uses the facility of Lower Merion High School (Ardmore, PA). This course is taught for 1 h per week, once a week for 10 weeks. We used Master Nishino's book as the text (16). The participants signed a consent form before participating in the course. (Previous experiences of participants can be found in Supplementary Table 1 in the journal's website.) In each class, we spent the first 30 min practicing the 'Breathing exercise' and the second 30 min the 'Taiki-practice'.

The Taiki-practice literally means 'paired *Ki*-practice'. By combining his experience in ballet choreography and martial arts, Nishino first acquired by himself the technique of Toh-Ate. Then, he developed it into the form of Taiki-practice so that anybody could practice and enjoy regardless of their martial arts experience. This is basically the exchange of *Ki*-energy (or *Ki*-communication) between the instructor and the student (16). The Taiki-practice starts with the following Taiki-motion: An instructor and a student touch their hands with each other (right hand to right hand, and then, left to left) and push with *Ki* alternately. When the instructor sends a strong *Ki*-signal and extends his or her hand, the student is pushed by instructor's *Ki* and steps backward to the wall, which is covered by a soft cushion (we used either a bed mattress or an air mattress). Nishino discovered that the individual's *Ki*-level grows through this practice.

A criticism of NBM was that the Taiki exercise may involve a psychological or hypnotic effect because the student 'watches' the instructor. Therefore, we made two modifications to the original Taiki exercise to eliminate that bias.

- (i) After S.T.O. extended his hand and a student was pushed to the mattress, he 'instructed' the student to run toward the opposite side of the room, where another mattress is leaned up against the wall. When the student started running, he 'pulled' the students with 'pulling *Ki*' (Fig. 2A). We found that some of the first-day students were 'pulled back' by S.T.O.'s *Ki* and started running into the opposite direction. Examples of this 'Pull-back-runner test' (PBR test) is shown in Supplementary Fig. 1. Since the student was running away, there is no possibility that he or she can 'watch' the instructor. The data are shown in Supplementary Table 2, where the 'Respond' column indicates the result of the PBR test on the first day. To S.T.O.'s *Ki*, altogether, 11 out of 37 responded (success rate: 29.7%).

The most amazing result was that these 11 'sensitive' students were also 'pulled back' by a 'pulling *Ki*' of some of the first-day students (see the 'Send' column in Supplementary Table 2. After 7 weeks in the MLSN

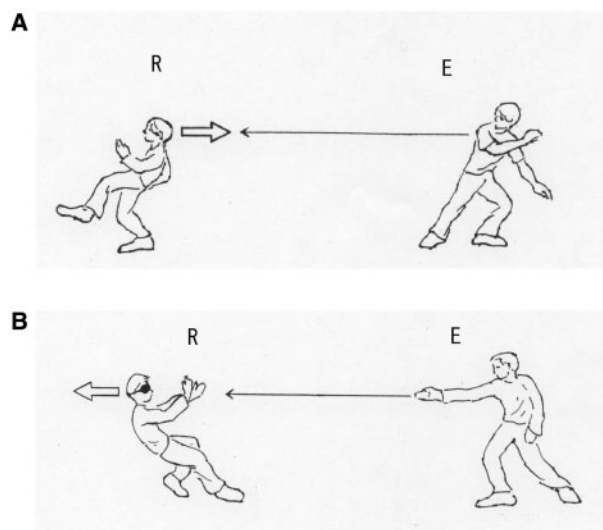


Figure 2. Relationship between the flow of *Ki*-energy (shown by thin arrows) and the direction of body movement (shown by open arrows). (A) 'PBR' test. E indicates a *Ki*-emitter, and R a *Ki*-receiver. *Ki*-emitter sends an unspoken message of 'Come back!' The receiver responds to the message and comes back. This test cannot be explained by a simple 'energy' theory. The 'entropy' aspect must be considered. (B) 'Face-to-face Taiki' test with a blindfold and without touching. The *Ki*-emitter sends an unspoken message of 'Go away!' The receiver responds to that message and moves backward.

program, the number of students who responded to S.T.O.'s *Ki* in the PBR test was 13/25 (52%). The number of students who can move other students in the PBR test was the same. The percentages of success rate for the seventh and tenth weeks were the same.

- (ii) In the Taiki practice (which is done in a face-to-face position), we asked the *Ki*-receiver to wear a blindfold, and the *Ki*-emitter attempted to move the receiver without touching hands. We call this the "Face-to-face" test (FTF test) (Fig. 2B). The actual examples are shown on the Supplementary Fig. 2A. The data for this test are shown on the Supplementary Table 3. This test was much harder than the PBR test. When S.T.O. sent *Ki* without touching the beginners who wore a blindfold (TFT test), none were moved on the first day. Only after the seventh week, 7 out of 25 were moved. Supplementary Fig. 2B shows photos of TFT-test between beginners on the fifth week.

Experiments to Show that the 'Ki-beam' has 'Information'

In 1978, Chinese scientists discovered that a Qigong healer's hand was emitting infrared radiation (35). This was later confirmed by Japanese scientists (38). Through our study, we also demonstrated that *Ki*, which caused *in vitro* effects on biological systems, and *Ki*, which

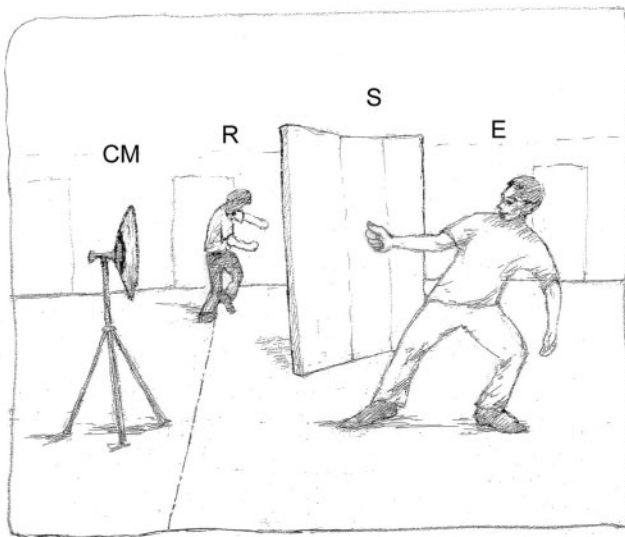


Figure 3. Schematic illustration of the 'Pull-back-through-a-mirror' experiment, which shows that *Ki* has information content. Note that an infrared shield (S) was placed between the emitter (E) and the receiver (R) in order to eliminate possible direct interactions. (CM) indicates a convex mirror. A broken line indicated on the floor is showing the passage of (R), who runs away toward the wall. When (E) sends a 'pulling-*Ki*' to the image of (R) in the mirror, (R) responded to the *Ki* and changes the running direction to run in the opposite direction. (For actual examples, see the supplementary material.)

caused Taiki-motions, was the same and both were NIR between 800 and 2500 nm (25,26). Recently, we proposed a hypothesis that *Ki* may be a laser-like NIR with a wavelength around 1000 nm (34). Being NIR, *Ki* definitely has an 'energy' aspect. However, we found evidence that *Ki* also has an 'information' (or an 'entropy') aspect (29).

We reported already that a mirror could reflect the '*Ki*-beam' and that the reflected beam pushed back a sensitive student in the same way as the straight line *Ki*-beam (34). If *Ki* has only an 'energy' effect, it would be easy to think that both straight *Ki* and mirror-reflected *Ki* have the 'push-back' effect. We could simply imagine that *Ki* energy is something like an 'energy flux' pouring out of the emitter's hand and pushing back a student by its energy flow (Fig. 2B). Then, the effect of a mirror is simply to bend the direction of the energy flow.

We experimented on whether we could 'pull back' a running student from behind using a mirror reflection. First, we used a flat mirror, which was similar to the one we used previously to reflect *Ki* in the face-to-face Taiki exercise (34). This experiment worked. The runner, who was running away from the *Ki*-emitter, felt the 'pulling *Ki*' and changed direction to come back (Supplementary Fig. 3). However, we found it rather difficult to catch the image of a running student, which appeared on a flat mirror but quickly disappeared (Supplementary Fig. 4A). Therefore, we switched to a glass convex mirror (diameter 35cm; this is sold at hardware stores as

a driveway mirror). Since the convex mirror allows us to view a wider area than a flat mirror, the image of the runner is always in the mirror (Supplementary Fig. 4B). Therefore, it is easy to send *Ki* to that image for pulling. In order to make sure that the *Ki*-energy, which reached the runner, was from the mirror, we placed a *Ki*-shield (Super Tuff-R™ heat insulator; Dow Chemical Co., Midland, MI) between the emitter and the runner (Fig. 3). This material was used in the previous study, and we demonstrated that it blocked *Ki* (34). As shown in Fig. 3 and Supplementary Fig. 5, we succeeded in pulling back the runner by sending *Ki* to the runner's image in the mirror.

If we think of *Ki* having only an energy aspect, it would be difficult to explain why we can 'pull back' a runner from behind. The direction of the *Ki*-energy flow and the direction of the pulling motion are in the opposite direction (Fig. 2A). It would be even harder to explain why this can be done with the mirror-reflected *Ki* (Fig. 3).

A possible explanation is to postulate that *Ki* contains 'information', and that the runner moves in accordance with the 'information' sent to the runner. In the experiment shown in Fig. 2A, S.T.O. sent an 'unspoken' message of 'Come back!' In the case of Fig. 2B, S.T.O. sent another 'unspoken' message of 'Go away!' We believe that the unspoken message was carried by *Ki*, and the receiver received the message. In analogy, *Ki*-energy is like a radio wave, and the information (to push or to pull) may be super-imposed by modulating the carrier wave (29,30).

Energy can do the work. The energy in gasoline can move a car, but energy can neither control its speed nor direction. Namely, energy cannot carry information. The driver must give 'information' by operating a gas pedal or a steering wheel. Other examples: writings or poems contain information, which essentially consists of complex arrangement and combination of letters. Music is made of pitches of sounds, intervals between notes and combinations thereof. Paintings are composed of the combination of paints with different colors, dark or bright and transparent or opaque. In essence, 'information' is related to the 'combination'. The quantity related to 'combination' is called 'entropy' in physics. Entropy is a different physical quantity from energy. Shannon described that information is related to entropy (40).

Yoshiya Shinagawa pioneered the discovery of 'transpersonal communication' between Qigong healers and volunteers (36,37). He proposed that *Ki* has an 'information' aspect. We also emphasized the 'entropy' aspect of *Ki* (29). The energy cannot carry information, but entropy can. The role of entropy in living organism was first introduced by Schrodinger (41). Its role in CAM was also discussed (9). In the healing art, which employs *Ki* or *Qi*, the mind of the healer may be transmitted with *Ki* as information. Therefore, the information aspect of *Ki* would be expected to play an important role in CAM.

Why can some Beginners Send and Receive *Ki* from the First Day?

Why could some students not only receive *Ki*, but also send *Ki* to other students from the first day (Supplementary Table 2)? A possibility is that all human beings once possessed the abilities to 'send out' and to 'receive' *Ki* to and from other people. This 'life-to-life' communication might have been essential to human beings for their survival. However, since they learned to use language for communication, and because of the development of civilized living, they gradually lost these abilities. However, when an emergency situation occurs, for example, when a loved one has fallen ill or is involved in accident, it is natural for other family members to send *Ki* in an attempt to save the life of their loved one. Therefore, people still maintained the ability to send *Ki* until the present day.

Ki may be Related to the Rhythm of Life

Most students, who were enrolled in MLSN-1 course, were interested in *Ki*-phenomena. They had experience in different forms of *Ki*-practice or martial arts. Some had training in music or dance. On the other hand, most of students enrolled in MLSN-2 did not have that experience. Perhaps the difference between the success rate of the first-day PBR test for MLSN-1 students (42.9%) and that for MLSN-2 (9%) was caused by a difference in the students' experience (Supplementary Tables 1 and 2). It is natural that previous training in martial arts or other *Ki* practices is advantageous in learning *Ki*. However, why is the training in music or dance helpful in learning *Ki*? A common factor in music and dance is rhythm. It is well known that our life activities have rhythms, for example, heart pulsation, breathing, a daily rhythm, monthly rhythm and yearly rhythm. The universe also has rhythms; the earth turns once a day, the moon orbits once a month and the earth travel around the sun once a year. Therefore, if *Ki* is a function of life, then rhythm may be an important element of *Ki*. This may be the reason why some people who have had serious training in music or dance were found to have a high sensitivity toward *Ki*.

Although a considerable percentage of the beginners could sense *Ki* in a 10-week course, this does not mean that 10 weeks is enough to master *Ki*. As we discussed in this commentary, the essential requirement for the Eastern way of practice is 'discipline and continuation'. You can become a master of any of the Eastern arts only when you are dedicated to life-long continuous practice. Nevertheless, the finding that a substantial percentage of beginners could feel *Ki* either from the first week or at least in 10 weeks, is very encouraging. It gives us hope that we could learn and use *Ki* for improving our health with a reasonable amount of practice time.

In conclusion, the significance of our findings in relation to CAM is 3-fold: (i) *Ki* has both energy and entropy (information) aspects. In the healing art that employs *Ki*, the mindset of a healer may be transmitted to the patient as 'information'. (ii) If beginners have had sufficient training in *Ki*-related practices, martial arts, music or dance, about 50% of them could sense *Ki* after a 10-week practice of NBM. (ii) The practice of breathing to enhance the *Ki* level may in-essence help to restore the original ability of human beings. Therefore, it may contribute to improve our health, wellness and life itself.

Supplementary Data

Supplementary data are available at *eCAM* online.

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