# HIDDEN COUPLING BETWEEN ANTISYMMETRIC WAVES IN THE BRAIN COULD BE LIMITING THE RELIABILITY OF THE SCIENTIFIC METHOD


## ABSTRACT

Everyone is familiar with the phrase: “seeing is believing”. The scientific method consists of collecting data through observation and experimentation and formulating and testing hypotheses. But with the human mind, what you observe is not what you think. The train of human thought is best described by the switching of two antisymmetric waves having the same phase between a symmetric and two alternative antisymmetric couplings. This results in observation systems working in a way connected to but different from hypothesis processing systems (like particle/wave duality). Recognising this hidden dynamic antisymmetry in human thought has huge implications for mankind, especially in the construction of the systems which humans use to structure their behaviour.


## DISCUSSION

Movement of the human body is effected by the skeletal musculature. It can, within limits, be placed under conscious control. For example one can assume conscious control of breathing, but this will be overridden if a life-threatening situation arises.

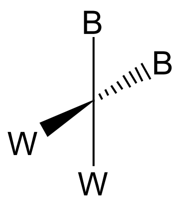
The skeletal musculature is responsible for maintaining and changing posture. The brain is able to effect changes in posture by co-ordinating the actions of individual muscles making up the musculature. The muscles are arranged in antagonistic pairs: flexor and extensor. In the steady (non-moving) state, the muscles in an antagonist pair are generally both partially contracted; i.e. the muscles are toned. When the muscle pair effects a movement, one muscle contracts as the other extends. Thus, the relative position of the two muscles can be described by a position on a line of fixed length, the ends of the line representing the limits of contraction/extension of the muscle pairs imposed by their physical state (e.g. in an arm or a leg). The motion of the muscle pair is antisymmetric, which means that the muscle pair needs to be described by a wave consisting of two non-interfering waves, which waves are 180º out of phase. The amplitude of the (each) wave is related to the relative positions of the two muscles in their contraction/extension cycle. However, there is nothing in the wave that describes the position of the two muscles in their contraction/extension cycle at any point in time. This needs to be determined by observation (using the body’s senses).

If the motion of the relative position of an antagonistic muscle pair is periodic relative to time, then the way in which the relative position of the muscle pair changes with respect to time can be described with a sinusoidal wave. Two orthogonal sine waves 180º out of phase can have a clockwise or anticlockwise sense relative to an observer. A sine wave describes motion of a particle at constant speed around a circle. In the human body, the motion of the relative position of an antagonistic muscle pair relative to time is often not periodic. The relative position of the muscle pair can pause relative to time, or change in a non-uniform manner relative to time. A wave function that describes motion of a particle at constant speed around a loop could describe this. Accordingly, two such non-interfering wave functions 180º out of phase could describe all possible motions of the relative position of an antagonistic muscle pair. Curiously, if time was non-uniform, and could itself be described by such a wave function, then the motion of the relative position of an antagonistic muscle pair could still be described as sinusoidal. Accordingly, it is helpful to disregard time and focus only on the phase relationship that characterises antisymmetry. (Perhaps antisymmetry is something independent of time, if indeed time exists outside the confines of what is observable).

When a planar wave, such as a sine wave is drawn out on a plane using Cartesian co-ordinates, the x-axis represents time and the y-axis amplitude. Looking at this along the edge of the plane as if the x-axis is coming towards you, the planar wave reduces to a line extending by the distance of the amplitude above and below the point that represents the x-axis. The phase reverses when the line crosses the x-axis.

Accordingly, the antisymmetric motions of muscles in an antagonist pair can be represented as shown in Figure 1 below. For the purposes of this discussion this representation will be called a chiralkine.

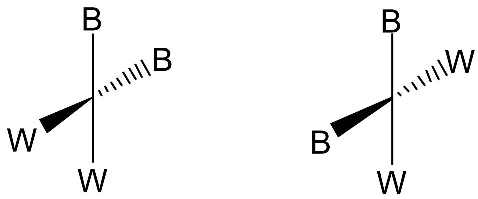
**Figure 1**




**Chiralkine**

In the representation shown in Figure 1, the two vertical lines represent the sine wave for the flexor in the plane of this page and the other two lines represent the extensor in a plane perpendicular to the page. The phase information is provided though the letters B (for black) and W (for white). Considering only the symmetry of the structure of an antagonist muscle pair as you can see it, the phase of the wave for the flexor can be B or W when that for the extensor is W and W or B when that for the extensor is B. There are thus two waves that can describe a muscle antagonist pair and they are mirror images of one another. These are shown in Figure 2 below.

**Figure 2**

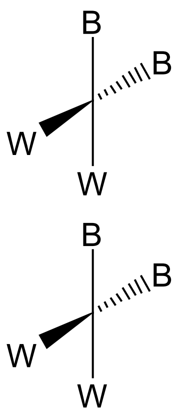



**Mirror Pair of Chiralkines**

However, muscle tissue, like all living matter, is composed of chiral building blocks. Muscle is composed of proteins that in turn are composed of amino acids. Because of this, the antagonistic muscle pairs cannot be described by both wave functions at the same time. The chirality in the composition of the muscle pairs splits the wave functions so that they are no longer the same. A given antagonistic muscle pair can be described by only one of these two waves.

The brain is able to co-ordinate the motion of two or more muscle antagonist pairs on the same side of the body. If the overall motion is to be cyclic, the motions of the pairs must couple together in a symmetric or an antisymmetric manner. Certain of the pairs can perform at frequencies that are harmonics of the others. Two chiralkines coupled in a symmetric or an antisymmetric manner are shown in Figures 3 and 4 below.

**Figure 3**

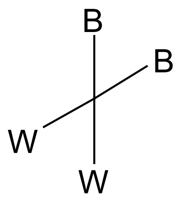


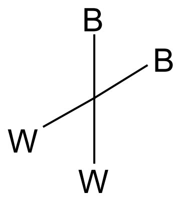

Symmetric

**Two Chiralkines on Same Side of Body**

**Coupled in a Symmetric Mode**

**Figure 4**




Antisymmetric

**Two Chiralkines on Same Side of Body**

**Coupled in an Antisymmetric Mode**

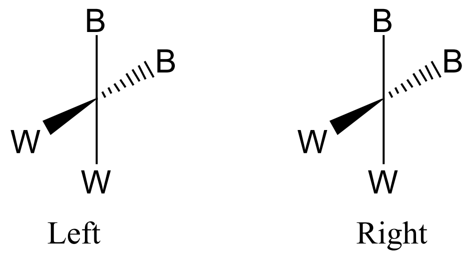
In the symmetric coupling, all of the waves are coupled in phase. The spins are the same. In an antisymmetric coupling, one of the waves is coupled in phase and the other is not. The spins are still the same. Imagine the line between one B and W forming an axis about which the other B and W rotates (so the rotating B and W become invisible). There are two possible antisymmetric couplings, one for each possible B-W coupling.

The brain is also able to co-ordinate the motion of two or more muscle antagonist pairs on opposite sides of the body. When the motion of such counterpart pairs is co-ordinated to effect an overall cyclic motion (as in clapping or walking), the motions of the pairs must again couple together in a symmetric or antisymmetric manner.

Since the body possesses bilateral symmetry, each antagonist muscle pair possesses a counterpart that is its mirror image. Accordingly, if one of the two possible chiralkines represents the motion of say a right antagonist muscle pair, then the other represents a left antagonist muscle pair. It follows that chiralkines depicted in the same way for both antagonist muscle pairs on both sides of the body have opposite spins. This is critical for them to be able to couple.

Figure 5 shows chiralkines for a mirror pair of chiralkines representing a symmetric movement cycle (as in clapping).

**Figure 5**



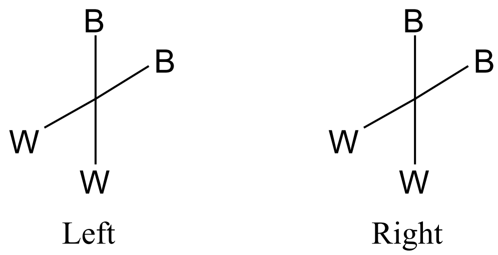

**Chiralkines on the Left and Right Sides of the Body**

**Coupled in a Symmetric Mode**

The two waves represented by B-W are all in phase with their spins opposed and hence matched up.

Figure 6 shows chiralkines for a mirror pair of chiralkines representing an antisymmetric movement cycle (as in walking).

**Figure 6**




**Chiralkines on the Left and Right Sides of the Body**

**Coupled in an Antisymmetric Mode**

One of the waves is coupled in phase and the other is not.  The spins are opposed and hence matched up. Imagine the line between one B and W forming an axis about which the other B and W rotates (so the rotating B and W become invisible).  There are two possible antisymmetric couplings, one for each possible B-W coupling.

That the two antisymmetric motions are different can be appreciated by thinking of two people walking together in step.  They can both put their feet on the same sides forward or their feet on opposite sides. Usually people end up putting their feet on the same sides forward. Another way of thinking about this is to imagine walking on squares along the columns of a chess board.  Starting from the same point and putting either the left of the right foot forward first, the feet will end up walking on the black or the white squares.

As a general principle, chiralkines can couple only if they posses at least one wave in phase.  When they couple, the in-phase waves combine to form a new wave that describes aspects of the motions of all the coupled chiralkines.  It is possible for chiralkines representing large numbers of muscles in the body to couple, enabling the whole body to move in a single co-ordinated way.

The phase of chiralkines is independent of the relative positions and relative orientations of the antagonistic muscle pairs that they describe. That this must be so can be appreciated by recognising that antagonistic muscle pairs can be coupled independent of their relative positions or orientations. It follows that the phase of each chiralkine is independent of time.

Every musician knows that antagonist muscle pairs can couple such that the ratio of their "beats" is a ratio of whole numbers. For two coupled antagonist muscle pairs, if the ratio of beats is x:y, the whole cycle repeats every xy "beats". The values of x and y can be the same or different prime numbers, or each can be the product of two or more prime numbers, but none of the prime factors of x can be a prime factor of y. Thus there is a relationship between the phase of chiralkines and the properties of numbers that arises due to coupling of chiralkines across the two sides of the body. It has been noted in recent publications that the prime factors of large numbers can be determined by exploiting the phenomenon of interference between two waves in phase (Zubairy, Science, Vol. 316, p554, 2007).

"Beats" and the production of numbers by counting are observations. The relative positions and motions of the parts of the body as the body changes posture through "time" are observations. There is nothing in chiralkines that describes them.

The function of an antagonist muscle pair is to perform work and thereby effect changes in movement of the muscle antagonist pair with respect to some reference point. The work is performed by flexor and extensor muscles as they contract. The amount of work being performed by the antagonist muscle pair varies over the muscle cycle. Thus the work being done can be represented by a position on a line of fixed length, the ends of the line representing the upper and lower limits of the work being performed at any point in time over the whole cycle. The motion of the muscle pair is antisymmetric, which means that the muscle pair needs to be described by a wave consisting of two waves at right angles to one another, which waves are 180º out of phase. The amplitude of the (each) wave is related to the work done by the two muscles in their contraction/extension cycle. However, there is nothing in the wave that describes the work being done by the two muscles in their contraction/extension cycle at any point in time. This needs to be determined by observation (using the body's senses).

Following the analysis of the relative position of the muscle antagonist pair, one comes to the conclusion that the work performed by a muscle pair can also be described by a chiralkine having the same phase properties as that describing relative position. Thus, an antagonist muscle pair can be described by two chiralkines: one a position chiralkine and the other a work chiralkine. These two different chiralkines can couple symmetrically or antisymmetrically. If the coupling is symmetric, the work done can be thought of as having no action on the relative position of the antagonistic muscle pair. If the coupling is antisymmetric, the work done can be thought of as acting in one direction or the other. Thus, a symmetric coupling would correspond to the antagonistic muscle pair being in a stationary, toned state. An antisymmetric coupling would correspond to the antagonistic muscle pair being biased towards or against an external reference point.

Change in the couplings between a position chiralkine and work chiralkine between the symmetric and the two antisymmetric arrangements results in changes of state of an antagonistic muscle pair between toned, pushing and pulling. It is very easy to change couplings, such that movement of a muscle pair can be started, exactly stopped or reversed. The symmetric coupling is very important. It would be very difficult to stop movement without it: one would have to hunt between pushing and pulling for an exact balance.

The three possible couplings between position and work chiralkines map to zero (symmetric), forwards (antisymmetric) and backwards (antisymmetric). The concept of zero, or nothing, is a dynamic construct of the brain. When we are observing zero or nothing, something is going on in the brain that we are not aware of. When we observe that an antagonist muscle pair is not changing, something hidden from our view is changing. When we a start thinking about a symmetric pair of opposites and then start to think about a mid-point between them (zero), there is another pair of opposites waiting ready to come into mind. This observation of the collapsing of one pair of opposites as another opens up takes place when chiralkines re-couple. It is inherent in the properties of two antisymmetric waves having the same phase that can change between a symmetric and two alternative antisymmetric couplings.

The brain can associate frequently combined chiralkines into groups, which enables it to efficiently select appropriately co-ordinated patterns of movement in response to a given need. For example, the brain can learn to associate chiralkines involved in a walking motion. This association is, in effect, memory. Learning movement cycles like walking, jumping, riding a bicycle or effecting a golf swing, involves the formation of associations of chiralkines.

Associations of chiralkines need to be distinguishable one from the others if their members are to be efficiently selected and coupled when required. They need to be classified. Classification can be in terms of single complex movement cycles (think of pronouncing a letter), particular combinations of movement cycles (think of pronouncing a word), or particular combinations of combinations (think of reading out phrases, sentences, paragraphs and books). Thus, association of chiralkines produces a language. Curiously, the movement cycles required to produce sounds (pronounce letters) all appear to be symmetrical. Speaking and singing are all symmetric. Writing appears at first sight to be asymmetric. However, it is possible to write in mirror writing with one hand at the same time as writing with the other. Co-ordination between the left and right hands can easily be switched on or off, presumably due to switching between a symmetric (stop) and antisymmetric coupling.

Thus to summarise what has been described up until now, an antagonistic muscle pair can be described by a relative position chiralkine and a relative work chiralkine coupled in a symmetric or one of two antisymmetric modes. The relative position chiralkines and relative work chiralkines of antagonistic muscle pairs on each side or on opposite sides of the body can be coupled together so as to co-ordinate these muscles. The coupling can be symmetric or antisymmetric. Symmetric couplings of relative position chiralkines with relative work chiralkines stop movement. Changing from one kind of antisymmetric coupling of relative position chiralkines with relative work chiralkines to the other reverses movement. Changing the relative amplitudes of coupled position and work chiralkines can be exploited to effect rotation of the body, for example by having different stride lengths on the two sides of the body. Symmetric coupling of relative position chiralkines results in antagonistic muscle pairs moving together in a symmetric manner (if they are in an antisymmetric coupling with relative work chiralkines). Antisymmetric coupling of relative position chiralkines results in antagonistic muscle pairs moving together in an antisymmetric manner (if they are in an antisymmetric coupling with relative work chiralkines). Memory results from association of chiralkines, such that they can readily be coupled as groups. Language arises from this process of association.

Now, it seems likely that all higher cognitive processes evolved out of an ability to control movement. Accordingly, it seems reasonable to suppose that abstract thinking is handled in the same way as the co-ordination of movement. Thus, if solving a movement problem (effecting a change of posture) involves changing the couplings between chiralkines as between symmetric and antisymmetric, then so too does abstract thought. The brain can only think what it can simulate by changing posture.

If this analysis is correct, it follows that the train of conscious human thought consists of forming and breaking couplings between chiralkines in symmetric and antisymmetric modes. The symmetry of the chiralkines and the bilateral symmetry of the body combine to limit the set of possible couplings. However, this set is vast, and underpins the huge diversity of human behaviour.

The theory of chiralkines, if correct, explains many things, but it is as yet incomplete. It still needs to account for how observations are processed so as to effect changes in couplings between chiralkines.

As already pointed out, relative position and relative work chiralkines contain no information about the actual position of an antagonist muscle pair in its cycle, nor the work being performed by the muscles at that position. This can only be determined by observation, by using the senses.

The sensory system must be capable of converting input that can seemingly have any value into dynamic packages (like separating white light into distinct colours or noise into sounds). These packages must be able to change couplings between position and work chiralkines. Accordingly they must possess the same antisymmetry and phase as position and work chiralkines. Since neurones are composed of the same chiral building blocks as muscle cells, it seems reasonable to suppose that these packages are themselves chiralkines.

To the conscious mind, an antagonist muscle pair appears to be behaving like a particle with mass travelling in time up and down a line under the influence of two antagonistic forces. That is what the conscious mind constructs from incoming sensory information. However, hidden from the conscious mind, all information about position and work is stripped away. Sensory input is coded into chiralkines. These can couple with position and work chiralkines of skeletal muscle, so effecting changes between the couplings of these position and work chiralkines.

The amplitudes of sensory and muscle chiralkines and their couplings change to restore equilibrium following a perturbation. An "observation" initiates a movement problem that needs to be solved by effecting a change in posture. When the posture change has been completed, change is no longer being observed and so equilibrium is restored.

Everyone is familiar with the phrase: "seeing is believing". The scientific method consists of collecting data through observation and experimentation and formulating and testing hypotheses. But with the human mind, what you observe is not what you think. The train of human thought is best described by the switching of two antisymmetric waves having the same phase between a symmetric and two alternative antisymmetric couplings.

Allowing limited conscious control of couplings enables experimentation in a safe mode. Within the limits that the brain will allow (to protect our lives), we can experiment with couplings. We can test new couplings and model whether or not they model patterns in sensory input. Many couplings will not work. These are mistakes. Those that do can be associated, forming a memory. This experimentation with couplings is the basis for creativity (forming new couplings) and innovation (testing new couplings, discarding those that are mistakes and forming associations for those that model sensory input).

A huge evolutionary benefit was gained with the emergence of limited conscious control of the skeletal musculature. It enabled learning through observation and experimentation. It enabled adaptation to an environment behaving or changing in behaviour in a way that could be modelled by couplings or changes in couplings. Parents could pass on the benefits of their experimentation and learning to their offspring, independent of their genetic code. Successful adaptations could be passed on without relying upon natural selection. Mistakes could be made and learned from by a mechanism that did not involve death. Individuals, even belonging to different species, could co-operate to identify new couplings of mutual benefit. Teamwork could develop, as several individuals could co-operate to test new couplings that form patterns only manifested when they work together. Here is the basis for the rich diversity and dynamism of human culture.

The safety limits that the brain places upon experimentation with couplings, and the huge benefits that have been gained through innovation, are encouraging ever more innovation and closer co-operation between individuals. We now have "globalisation". It is as if the population of the whole world is falling into step. There is a huge danger for all life lurking beneath this. The safety limits imposed by the brain evolved over vast period of time through a mechanism that punishes mistakes by death of individuals. Genes encoding for poorly adapted behaviours are selected against. This mechanism is still very much in operation today, but it has not had time to identify and impose safety limits upon experimentation with couplings between individuals. Every new technical or social innovation, from deep water drilling for oil to mortgage-backed securities, is an experiment conducted without safety limits.

The symmetry that enables conscious co-ordination of movement and links together the elements of abstract thought is largely hidden from view. Humans often invent systems, for example to co-ordinate behaviour (as in a game) or regulate relationships (as in a legal or monetary system). If the elements of these systems do not map in all respects to the co-ordination of movement, then the systems will eventually fail – whether or not they are properly adapted to the external world. A common error is to treat an element of a system as if it is symmetric when in fact it is antisymmetric. For example + and – are often used as symmetric opposites, even by physicists and chemists representing the phases of waves! Yes and no are frequently miss-used, either by treating them as symmetric opposites or by using them interchangeably. Untold damage has been caused by banks treating debit and credit as symmetric opposites, leading to uncontrolled creation of money. These failures to take account of antisymmetry can lead to catastrophic failure. The concept of antisymmetry was well embedded in ancient Chinese culture. It is manifested in the concept of yin and yang. It is absent from Western and Islamic culture. Walking through a Western museum, like the British Museum or the Louvre, one can see artefacts selected to be representative of the best produced by a culture in a period of history. None, even those selected to be representative of ancient Chinese culture, embodies antisymmetry – the concept of chiralkines. Simple bilateral symmetry is found in abundance, in everything from the patterns in a Persian carpet through decoration painted on an

Egyptian sarcophagus to the three-dimensional form of a Greek temple. Mankind is walking confidently towards an abyss, blissfully unaware of the hidden antisymmetry that entrains all human thought.

The valuable resource that evolution created when it allowed conscious control of chiralkines is being used up. The greater the number of chiralkines that are coupled, the less the freedom for creativity and innovation, hence the less adaptability to environmental change. It is like playing the game of free cell when the number of free cells has almost been used up, or working on a computer whose hard disc is almost full. The explosive arrival of the internet has permitted unprecedented levels of coupling. It is leading to the adoption of global standards for everything, and the formation of larger and larger organisations to perform functions previously performed by great diversity of smaller ones. Diversity is draining away. Reducing the threat of this danger will require widespread appreciation of the concept of antisymmetry and its deep integration into all aspects of human culture. It will require embracing diversity, creativity and innovation as precious, limited resources that can only be maintained under conditions where it is "safe" to make mistakes.

**CONCLUSION**

The ancient Chinese recognised that dynamic antisymmetry permeates all aspects of life. They developed a phrase for it: yin yang. Over millennia, Western culture and the scientific method have crowded out this concept, except in the arcane field of quantum mechanics. It is often represented by the Taijitu symbol, a disc that bears antisymmetric black and white markings. People struggle with the yin yang concept. They try to interpret it in terms of opposites like good and evil, or try to see two opposites as each being composed in part of yin and in part of yang. To understand better how the human mind works, you have to think of the markings on two Taijitu symbols coupled in motion. When you see this for the first time, it feels like enlightenment. From then on you start to be able to see the hidden antisymmetry in human behaviour, and the symmetry errors that are presently being made in language and the systems that are used to structure how people co-operate.