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Mental Imagery to Enhance Performance and Heal:

A Synthesis of Western and Eastern Methods

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Chapter 1

Introduction

Background of the problem

Whether referred to as mental imagery, guided imagery or visualization, the use of picturing and rehearsing action and behavior in the mind has a long history in cultures throughout the world. (Utay & Miller, 2006) This method has been used to assist in healing and growth in both psychological and physical realms. In recent years, the use of mental imagery has been utilized extensively in the fields of sport psychology and physical health. Imagery has been used to reduce anxiety, to increase performance, to help athletes focus and to try to help athletes enter flow states in competition. Shackell, & Standing (2007) found that mental training alone can increase muscular strength on a standing with physical training and also can lower blood pressure and heart rate. Robin, Dominique, Toussaint, Blandin; Guillot, & Le Her (2007) found that physical and imagery training can improve athletic performance in tennis. Even when imagery does not improve performance (at least partly as a result of the study design), it can facilitate factors that improve performance. Jones, Mace, Bray, MacRae, & Stockbridge (2002) found that imaging improves self efficacy and lowers stress thereby increasing persistence and effort. Munroe-Chandler & Hall (2004) found that imaging also increases collective efficacy which can lead to increased team performance. Hardy, Jones, & Gould (1996) report that imagery is a major part of every athlete’s performance preparation.

Many studies have found that practices such as qigong and taiji chuan can be used to improve health in areas such as blood pressure, arthritis, Parkinson’s disease, balance, joint flexibility, fibromyalgia, sleep disorders, stress reduction, and cardio-respiratory function (Y. Yang, 2005; Sancier & Holman, 2004). Qigong has been in use in China for thousands of years for health benefits and to improve performance in martial arts, such as taiji chuan (J. Yang, 1998).

Purposes of the study

Utay & Miller (2006) found that not much has been written on how mental imagery works and why it has the power that it does. Researchers such as Elich, Thompson, & Miller (1985) looked at the relationship of eye movement to imagery. Holmes & Matthews (2005) found an emotional element to imagery. Kosslyn & Thompson (2003) found that the activation of the visual cortex is particularly important in visual imagery.

The first part of the paper will deal with how imagery is used and the various theories of what mental imagery is and how it works. Brain research will be examined to look at how imagery works physically and at theories of how imagery causes change physically and emotionally. This paper will also look at imagery from a cultural view. Much of psychological research deals with imagery from a Western view – that is imagery as defined by how it is used in Europe and the United States. This paper will examine the similarities and differences between the two approaches – Western and Eastern (primarily Chinese) - and provide a synthesis of the two.

Theoretical framework

Kosslyn, Reisberg, & Behrman (2006) postulate that imagery takes place at the cellular level in the brain and to best understand the processes involved, studies need to focus on the physical processes of the brain itself. For example, what part of the brain is involved with visual imagery and is this area the same part that is involved in seeing. The sensing process is mechanistic and reductionistic. Chinese medicine, with its inherent philosophical underpinnings of Buddhism and Taoism, do not separate the process so much and use introspection to examine perception and have the underlying principle that forms or images or experiences are not able to be separated from context (Ricard, 2006; Watts, 1961).

Definition of terms

Terms to be familiar with in this paper include “imagery” and its similar terms, “qi” (sometimes referred to as “chi”), “qigong” (or “chi gung”), and “taiji chuan” (or “tai chi chuan”).

Weinberg & Gould (2007, p. 296) refer to imagery as “visualization, mental rehearsal, symbolic rehearsal, covert practice, imagery and mental practice.” Vealey & Greenleaf ((2006, p. 307) define imagery as “using all the senses to re-create or create an experience in the mind.” Hardy, Jones, & Gould (1999, p. 28) distinguish between mental imagery and mental rehearsal. They define imagery as “a symbolic sensory experience that may occur in any sensory mode” and as such is a mental process and a “mode of thought.” Mental rehearsal or going over a performance in your mind, on the other hand, is a technique or process which is better than no practice at all, when combined with physical practice is better than either alone, and works better for cognitive rather than physical tasks. Imagery is thus multi-modal and may include any or all of the five senses - visual, auditory, gustatory, olfactory, and tactile. Imagery may also include kinesthetic awareness, which is the innate feel of the body in motion. For this paper, the term “imagery” will be used throughout to encompass all the senses that are experienced in the mind during the process of imagining.

The history of qigong is traced back to the book, the *I Ching* or *Yi Jing* or *Book of Changes* which dates to before 1122 B.C.E. It was further developed when Buddhist monk Da Mo, or the Bodhidharma, came to China from India some time during the Liang dynasty of 502 – 557 A.D. (J. Yang, 1997). J. Yang enumerates several modalities of qigong – scholarly (for maintaining health – associated with Confucian and Taoist philosophies), medical (for healing), martial (for fighting) and various Buddhist or Taoist forms for enlightenment. Central to all of these is the Chinese concept of "qi", which is sometimes spelled "chi" in English. There are many types of qi, but for the purposes of this paper, qi is perhaps best understood as energy and in the human body as bio-electric energy. Traditional Chinese medicine seeks to heal and to maintain health by balancing and unblocking the qi flow in the body. Illness is thought to be caused by blockages of qi flow within the body. One may also have too much, too little, or stagnant qi, all of which cause health problems. The absence of qi is death. Healing and improvement in health and performance can be accomplished by the person performing physical qigong through imagery (directing qi flow with the mind) and by the healing touch of one who has mastered the practice of transferring qi. Qi flows throughout the body in twelve primary channels and is also stored in eight major vessels. Chinese medical techniques such as acupressure and acupuncture are based upon this system. Taiji chuan is an internal martial art that is also a qigong practice. Literally "taiji" means "grand ultimate" and takes its philosophy directly from the Taoist philosophy of Lao Tzu and the *Tao te Ching* and "chuan" means "fist". Fist connotes fighting bare handed or without weapons. Taiji chuan, or "grand ultimate fist" can also be thought of as a form of moving meditation. Mindfulness is increased as one's consciousness flows with the yin and yang of the movements and with the breathing which is correlated with the yin and yang of the movements. Intention (the purpose of the movement) and attention (to what you are doing in the moment) are vital parts of the training. Yin and yang are concepts from

Taoism. Everything has yin (darkness, female, death, cold, down, etc.) and yang (light, male, life, hot, up, etc.) elements or qualities, and one element cannot come into being without the other. A goal of taiji chuan practice is to move beyond this dualistic state to the original state of "wuji" where there is no duality. Both qigong and taiji chuan incorporate the five elements of Taoist philosophy – water, wood, fire, earth and metal – with again a goal of balance. There are several different families of taiji chuan. Among them are Chen, Yang, Wu Yu Xian, Wu Jian, and Sun (J. Yang, 1997).

Chapter 2

Literature Review

Theories and use of imagery in Western psychology, sport and healing

The operational definition of imagery in sport psychology traces its roots to Richardson (1969, pp 2-3) who defined the process as "those quasi-perceptual experiences of which we are self-consciously aware and which exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts." Rossman (2000, p. 13) describes imagery as a "flow of thoughts you can see, hear, feel smell or taste. (It is) an inner representation of your experiences of your fantasies – a way your mind codes, stores and expresses information." He goes on to state that imagery is an avenue to what he terms the "deep self" and has an effect on every system of the body including the hormonal, nervous, cardio-vascular, digestive, skin response, arousal systems, etc.

Individuals think in various ways using imagery and language. Grandin (2006) reports that he thinks exclusively in pictures with thinking more akin to movies, and that words are more a second language to him. Others involved with imagery research, such as Daniel Reisberg, report not being able to image, at least visually, at all. (Kosslyn, Ricard, Kanwisher, Reisberg, Behrmann, Wallace, and the Dalai Lama, 2006). Kosslyn et al (2006) further contrast the physicists Einstein and Heisenberg. Einstein relied on visualization for theoretical creation in his mind, while Heisenberg considered this process silly and seemed to rely on a thought process of mathematical conceptualization. An individual's ability to image runs the gamut from these two extremes. Just how well imagery works in improving performance is dependent at least in part on how skillful an individual is in the practice of imagery. Murphy (2005) reports that there are two key aspects to this ability – vividness and controllability – and expertise with these qualities improves the outcome of imagery use. He states that elite athletes have superior skill in both these elements over non-elites. Vividness refers to the depth and realistic feeling of the experience. If you are imaging a specific skill in soccer, you will be able to not only see the ball, but hear the sounds and smell the smells of the game. You will hear the sound of the ball when you kick it. You will taste the salt of the sweat running down your face to your mouth. You will also be able to "feel" the muscles of your body involved in the kick and the physical sensations of the kick itself.. You will have a sense of where your body is in space and your balance – the kinesthetic awareness of the experience. Controllability means that you will be able to control the outcome. Murphy (2005) reports athletes having difficulty with outcomes, for example, trying to image a specific dive and instead of imaging the dive in the correct form and feeling good about performance, emotions take over and the person images a bad experience such as hitting the board. Elites have better controllability of images as well.

Behncke (2004) emphasizes that for imagery to work, one needs to know how to perform effective imagery. He divides this knowledge into two components – procedural and declarative. Procedural knowledge is actually knowing how to perform imagery and having the correct image information in mind when rehearsing skills – the visio-spatial and temporal parts of imagery. The declarative part entails understanding the concepts underlying imagery so that you can fully implement the benefits of imagery. Understanding the process allows the imager to intervene in the process conceptually (the pictures) or symbolically (the words and reasoning) to make imagery more effective.

Murphy (2005) goes on to report the two methods or perspectives of imagery – internal and external. Internal imagery is imagery that is more seen through one's own eyes and body. You image from a first person perspective. To use the soccer example, you see the ball through your own eyes and feel the movement of your body from within yourself. External imagery is more third person in perspective. You view the scene as a camera. In effect you watch yourself perform the task from outside yourself. He goes on to say that Olympic athletes tend to use internal imagery more than external and that for learning and improving performance tasks, kinesthetic imagery is the most useful. Glisky & Williams (1996) compared groups of undergraduates (including a control group) on a cognitive/visual task (an angles estimation task) and a motor/kinesthetic task (a stabilometer task) using internal and external imagery. The external imagers had greater performance improvement on the motor/kinesthetic task and the internal imagers had greater performance increase on the cognitive/visual task. The results run counter to the notion that internal imagery is primarily kinesthetic and that external imagery is primarily visual. Participants reported variation in the type (visual or kinesthetic) of imagery utilized regardless of whether imagery was internal or external. The authors recommend using the terms “first person” or “third person” when discussing internal and external imagery rather than the modality of the imagery since modality seems to be independent of internal or external orientation.

Martin, Moritz, & Hall (1999) break down imagery in sport and its uses even further. They looked at the cognitive, affective, and behavioral outcomes of imagery use, and what type of imagery worked best with specific types of goals. They base the model on the conceptual framework of Paivio (1985). The first type of imagery is motivational specific (MS) and is related to external goals, motivation, and mastery, such as picturing one’s self winning a specific event. The second type is motivational general-mastery (MG-M), which is geared to internal motivation and strength – seeing your self as strong, confident, tough, and meeting challenges. The third type is motivational general-arousal (MG-A), which is geared to controlling arousal associated with competition such as “psyching up” or calming down when you are too keyed up to perform well. The fourth type of imaging is cognitive specific (CS) and is used for learning specific sports skills. This is related to an internal and narrow focus of attention. Your awareness is focused on the task and your skill in doing that task to the point of tunnel vision. The fifth and last type is cognitive general (CG) and is used in imaging competition events. This is useful more for increasing skills in situations that are broad and external in attentional focus, such as perceiving what is going on in the game (increasing ability to track where the players are moving, what they are doing, etc.) Athletes can use any one or any combination of these methods depending on the desired outcome. The authors use the Sport Imagery Questionnaire to measure how and how much an athlete uses these types of imagery. Imagery may be used to learn and practice specific skills or may be used to go over an entire game with alternative ways of handling specific issues that may arise during the game. Martin, Moritz, and Hall (1999) divide the use of imagery in sport into three different situations for use – training, competition, and rehabilitation. They recommend specific imagery use for each with a predicted outcome or effect for each one (Martin, Moritz, and Hall, 1999, p. 258). Motivational specific imagery is used in training and competition to “facilitate the setting of process, performance and outcome goals” and in rehabilitation to facilitate the “setting of rehabilitation goals and adherence to rehabilitation program.” Cognitive specific imagery is used in training to “facilitate learning and performance of skills”, in competition to enhance “performance of skills and facilitate mental focus”, and in rehabilitation to “facilitate learning of rehabilitation exercises, maintain sport skills, and promote healing.” Cognitive general imagery is used in training for “facilitating learning and performance of strategies”, in competition for enhancing “performance of strategies and to facilitate mental focus,” and in rehabilitation for “facilitating rehabilitation planning and strategies and to maintain sports strategies.” Motivational general-mastery is used in training and competition to help “increase self confidence and self efficacy, to help maintain a positive attitude, and to facilitate mental toughness.” It is used in rehabilitation for the same purposes and to increase adherence to rehabilitation. Lastly, motivational general-arousal is used in all three categories to “regulate arousal and anxiety levels.” The type of imagery used should differ according to the skill and style of imagery of the individual. Those whose cognitive style and ability is more verbal would not benefit as much or perhaps at all from visual imagery. One shortcoming of the model is that it does not specify how to use more than one skill at a time for a desired outcome, for example how to use motivational general-mastery to increase confidence and mental toughness while using cognitive specific imagery to teach a particular skill such as a parry and riposte in fencing coupled with instilling confidence in the ability, both of which would be done gradually and in steps.

There are several psychological theories as to how imagery works. Weinberg & Gould (2007) reviewed the work of Carpenter who originated the psychoneuromuscular theory in 1894 along with the ideomotor principle. Carpenter theorized that when a person images an action, the image activates the same psychoneuromuscular system that doing the action activates. The ideomotor principle postulates that learning is enhanced because the same systemic pathways in the nerves and muscles are used whether the action is performed or just imaged, even though the imaging does not enervate the system with the same intensity as the doing. Current research gives some support for this theory and will be examined later. Weinberg & Gould (2007) also outline the symbolic learning theory proposed in 1934 by Sackett. Sackett's idea was that individuals learn movement by using imagery to encode the series of movements in the brain. One could imagine that an athlete could have several sets of encodings so engrained in memory for use as contingencies in specific situations and that using an unconscious process similar to Bayesian logic, the athlete would respond "automatically" to situations. Smith, Holmes, Whitemore, Collins & Devonport (2001) found support for the use of including response scripts in work with field hockey players divided into two types of imagery groups plus a non-imagery control group. One imagery group was given stimulus only imagery for a penalty flick situation. The other imagery group was given responses to go with the imagery. In actual task performance, both imagery groups performed significantly better than the non-imagery controls, but the group which got both stimulus and response imagery performed significantly better than the stimulus only group. This study best supports the bioinformational theory of Lang (1979). The person has elements of both the stimulus and the response as part of the image and the action. The stimulus is the trigger to the action and the response set includes possible reactions to the stimulus. For the hockey players, the stimulus set would be things such as the sights and sounds of the game and the field – people in the stands, the score, etc. The response set would include things such as the emotion of the moment, the feel of the stick in the hand, the vision of the net and positions of team mates and opposition players and possible moves. The triple code, or ISM (Image-Somatic response-Meaning), model of Ahsen (1984) adds one more element – meaning. The three parts of this model are the image itself, the somatic response of the imager, and the meaning that the person gives to the image. Every image and imagery script will be interpreted differently by the individual, which makes it extremely important for the individual devising the script to work collaboratively with the person receiving the script. Murphy (2005) states that emotional shifts caused by imagery have an impact on performance, and that meaning also has an impact. He theorizes that this is due at least in part to the brain being largely organized by association and that learning and memory take place by association with prior encoded information. One of the reasons that imagery is effective is that it has more associational meaning than other processes. The magnitude of the meaning of imagery hit home for Murphy (2005, p. 137) when he used one script for a group of youngsters learning to figure skate. He asked them to visualize a ball of energy, then to have to ball enter the body and radiate calm and peace. The children's reactions ranged from perplexed with a feeling of being blinded by the brightness of the energy ball to fear as the ball of energy exploded inside the child. This is somewhat similar to the social learning theory of Bandura (1997) who posits in part that individuals learn from others through observation and that the individual and the environment feed back on each other so that one has an effect on the other. Observational learning is similar to modeling which is used in imagery. Meaning plays a key part in learning and retention. Powers (1991, p. 152) discusses how control theory uses imagination as a part of the mechanism of decision making and action. Control theory is a hierarchical function within the person (or encoded computer for that matter) which "works through continually comparing a perceptual version of the current situation with an inner specification for that perception. Action is driven by the difference or error" between what the person's inner specification says should be and what the person perceives.

From a developmental standpoint, it makes sense that both Bandura and Powers are correct. We are a part of the system in which we exist and each has an effect on the behavior and the learning or change of the other. Hewitt and Hummel (2003) reviewed the developmental theory of Jean Piaget, in terms of how we come to know what we know, and during that first sensorimotor stage (which has six sub-stages) there is no use of symbols, but learning takes place through experience and interacting physically with the environment. Children acquire object permanence or memory at about seven months, and language and symbolic thought begins to develop about the end of infancy. Greenspan & Shankar (2004) theorize that emotional thought and communication are what give rise to symbolic thought and communication and that individuals and cultures function best when the two are in tandem. Hupka, Lenton, & Huchison (1999) found support for the categorization of emotions in a study of sixty four languages, and found that emotions, at least linguistically, were developed in stages. Categories labeled first in cultures were related to anger and guilt. The authors speculate that this is part of a society's method of ensuring social control. The second stage was a combination of adoration, alarm, amusement, and depression. The third stage was alienation, arousal and agony with the fourth stage being one of eagerness. They found these stages to be true across cultures. It would be interesting to look at prescribed imagery in terms of the developmental stage, emotionally and linguistically, of individuals. Clarkson (1999) found that many elite athletes had experienced difficult childhoods and used anger in their imagery to help them excel in sport. Perhaps the imagery worked well because it matched the emotional developmental stage of the individual.

Holmes & Matthews (2005) examined the relationship between emotion and imagery. They looked at whether imagery would produce a greater emotional response than language. They based this hypothesis on research which found that imagery played a special part in representing emotionally charged material. This makes sense when one thinks of the imagery associated with flashbacks in post traumatic stress syndrome and with the well documented phenomena of state dependent learning. Stress inoculation therapy can use imagery to lessen the emotional distress associated with specific causes (Meichenbaum, 1996). Holmes & Matthews (2005) also based their theory in part on findings that words associated with images are more easily recalled than abstract words. Participants were exposed to recordings of one hundred situations with negative emotional outcomes with each followed by questions that were either factual and did not require imagery or that did require imagery. Those participants in the imagery group reported greater increases in state anxiety. They then performed a second similar experiment whose results replicated the first. Negative imagery increased anxiety more than negative words and the difference was the same regardless of gender. As is the case with just about all imagery studies, the authors could not be sure that those in the verbal group did not use imagery, but the input was controlled, and the results do indicate a relationship of imagery with emotion. This makes developmental sense in that we experience image input of all sorts before we learn language to put labels on the experiences. Holmes & Matthews (2005) specify that their study showed a relationship of imagery with anxiety, and that imagery's relationship with other emotions needs to be studied. Developmentally, imagery could be seen as at the root of our experiential processing and based on the work of Hupka et al (1999), emotions related to anxiety are the first that we develop linguistically. This further provides theoretical support for Holmes & Matthews (2005).

Jones, Mace, Bray, MacRae, & Stockbridge (2002) examined imagery specific to task following the model of Martin, Moritz & Hall (1999). The impact of imagery scripts on the performance and the feelings of perceived stress and self efficacy were tested on female participants in a climbing exercise. The types of imagery used were motivational general-mastery and motivational general arousal. These two types of imagery should increase feelings of self efficacy on the task, decrease anxiety and increase climbing ability. Measuring emotional arousal during a task is difficult due to the transience and sometimes rapid change of feelings. A second theoretical underpinning of the study was Lang's bio-informational model. The individual imagines the stimulus which arouses a feeling which affects and is associated with the response. All the climbers were novices who were taught to climb a 5.1 meter wall in four sessions. The Perceived Stress Index was used to measure stress levels before and during the climb. A Likert scale devised by the researchers was used to measure self efficacy and climbing performance was rated by two qualified mountaineering instructors. The control group took part in a light exercise program and did not receive imagery as part of the climbing training, which was otherwise identical. The actual performance scores between the two groups did not differ significantly, but the imagery group had lower perceived stress and higher self efficacy during and after the climb.

Motivation general-mastery was also found to increase self efficacy for a group in a study by Munroe-Chandler & Hall (2004). The purpose of the study was to test whether implementing a motivational general-mastery imagery intervention would increase a soccer team's collective efficacy or the team's shared belief of the team's capabilities to succeed in a given task. Fifteen female soccer team mates ages 10 to 12 with a mean years experience of 6.2 years made up the participants. The players were divided into three groups – forwards/strikers, midfielders, and defense/goal keeper. The intervention lasted 13 weeks of the 15 week season. Each week prior to practice, the players completed the Confidence Questionnaire. The Imagery Assessment Questionnaire was administered each week prior to the intervention. Athletes were given imagery scripts each week over 13 weeks. Weeks 1 – 3 were used to assess a baseline score on the Confidence Questionnaire. Imagery interventions began at weeks 4, 7, and 10 for the forwards, midfielders, and defense/goal keeper respectively. Imagery intervention consisted of 10 – 15 minutes of guided imagery with the sports psychologist consultant once a week. Athletes were asked to practice the imagery for 10 minutes each day and were given copies of the script. Forwards and midfielders increased in collective efficacy. Defense/goal keeper collective efficacy scores were unchanged. All players stated they used the imagery 4 to 6 times a week. Forwards found the intervention most effective (8.04 rating) versus 6.22 of midfielders and 6.04 for defense/goal keeper. Imagery intervention can increase collective efficacy. One reason why imagery may not have been as effective with defense/goal keeper was that imagery was introduced late in the season (two thirds over) – an effect of the study design. Since the first three weeks of imaging were considered establishing the baseline, the study lasted 13 weeks, and the defenders/goal keeper began imagery at week 10, they effectively did not receive the intervention and it is not surprising there was no effect. Also the team was also relatively high in collective efficacy before the interventions. Motivational general-mastery imagery should begin at the start of the season and athletes should be encouraged to use it both in training and competition. Since imaging skills improve with practice, they should be implemented daily. The authors feel that athletes as young as ten years old can be taught to use imagery successfully. They did not report whether the developmental stages of learning were taken into account or whether imagery was individualized. Both of these factors would affect the outcomes.

There are many other ways that imagery is used to increase many different types of athletic performance. Different types of imaging work better for different types of tasks. Sometimes it is difficult to differentiate where one type of imagery ends and another begins. For example, modeling may work better for initially learning a motor task than imagery, but in the mind, where do process and technique differentiate? SooHoo, Takemoto, & McCullagh (2004) compared the effects of modeling and imagery on performance and self-efficacy. The task they taught to twenty two college females was how to properly perform free-weight squat lifts. Their underlying theory of the effectiveness of modeling utilized that of Bandura (1986) who said that four processes must be present – attention, retention, production, and motivation. The person must observe the task mindfully to see what needs to be learned, the person needs to retain that information in memory to learn it, and the person must have the capabilities to produce the action learned. The individual must have some motivation and desire to learn and perform the action. If any of these is missing, the action will not take place, and most likely learning will not happen, either. The authors further build on Bandura's belief that as one learns and masters tasks the individual's self efficacy increases. As modeling and imagery increase learning and task mastery, self efficacy should increase, too. SooHoo et al (2004) do differentiate modeling and imagery by separating the source of the initial stimulus. With modeling, the stimulus is always external. Either a live demonstration or a movie is presented to actually show the behavior or task to be emulated and learned. The authors point out that in review, about half of the studies on imagery have a confounding variable such as including relaxation techniques or even modeling as a co-variable with imagery, so that it is not clear exactly what the effect of imagery alone is. In this study, the modeling group was shown a video of a female of similar age and characteristics to the participants (the authors found research indicating that modeling is more effective when done by persons similar to those learning the task) performing the task. The imagery group heard an audio tape instructing them how to perform the lift. The authors did admit that they could not be sure that the modeling participants did not image in their minds as part of their learning. The imagery ability of the participants was assessed using the Vividness of Movement Imagery Questionnaire to control for imaging ability. The individuals' style of learning was not tested or controlled. The modeling group was able to perform the task better at the end of the trials. However, both groups improved performance and both improved in self efficacy. One could argue that in actuality, both groups were modeling and imagery groups. Both received external instruction, which the authors call modeling, but one received visual and the other received auditory instruction. As the authors admit, they could not be assured that the modeling group did not image as they learned. In any case, imagery is not only visual, but includes all five senses plus kinesthetic awareness. Both groups were engaged in imagery, just with different styles of being taught, and each was using a different part of the brain to learn. It would have been interesting to test the learning styles and match style with imagery input and instruction. Ray, Horvat, Keen, & Blasch (2005) performed two case studies of teaching taiji chuan to individuals who were severely visually impaired and who had histories of falling and a fear of falling. This is a motor task and there would be no modeling as SooHoo et al (2004) defined it, but the individuals were able to learn the task well enough to improve balance testing scores, one significantly so. The teacher altered the training method from visual learning to verbal instruction with hands on movement of the person for kinesthetic awareness and the use of dowel spacers for the feet to help the individuals have a spatial awareness of placement. Improvement in self efficacy was not tested. Using the imagery definition of SooHoo et al (2004), it would be difficult to perform a similar study on teaching golf techniques to the blind. A perusal of the web site of the

United States Blind Golfers Association shows that blind golfers adapt to the game with coaches and by using techniques such as touching the ground on the approach to the cup to get a feel for the grass.

Fery (2003) compared kinesthetic and visual imagery in a task involving drawing a reproduction of a 36 cm long symbol carved into wood. They used a kinesthetic group, a visual group and a control group for training. All were tested with the Vividness of Movement Imagery Questionnaire to control for imaging ability in the participants. The kinesthetic group was blindfolded while learning the shape of the symbol. An assistant guided their wrists in tracing the outline. The visual group watched the assistant trace the outline and individuals were asked afterwards to rehearse mentally by watching themselves trace the outline. There was no control for internal or external orientation of imagery. The control group had distracting tasks to keep them from forming images of any kind. Both the kinesthetic and the visual groups performed better than the controls. Visual imagery was found to be better at improving performance that emphasizes form while kinesthetic imagery was better for tasks requiring timing or minute coordination with the hands.

Robin, Dominique, Toussaint, Blandin, Guillot, & Le Her (2007) looked at the differential effect of imaging by comparing a group of poor imagers with a group of good imagers with the hypothesis that the good imagers would benefit more from imagery training. The sample consisted of 80 right handed tennis players who had played for more than seven years, trained about 15 hours a week (for more than three years), and competed at the regional or national level. Of this group, 30 were retained after screening for proprioceptive/kinsethetic imagery and were assigned to three groups of 10 each – "good imagers", "poor imagers", and a control group of five good and five poor imagers.

The Movement Imagery Questionnaire differentiated between good and poor imagers. Measures also included accuracy of return of serve to a standardized grid on a tennis court. The use of internal visual imagery perspective was preferred because of its stronger impact on tasks with high perceptual requirements. Participants were trained in imagery, except for the control group, and accuracy of return was measured. Errors of return decreased for both imaging groups and remained unchanged for the control group. As expected, good imagers performed significantly better than poor imagers.

Greg, Hall, & Hanton (2007) used a combination of quantitative and qualitative methods to see what factors cause imagery to be more effective in some situations than others and to see why heptathletes in particular believe their use of imagery is effective. The authors hypothesized that the effectiveness of mental imagery would vary according to why the athlete chose to use it and when the athlete chose to use it. Six national team heptathletes who had participated in international track and field competition composed the sample. The women ranged in age from 20 to 31 years with a mean of 25.33. A qualitative measure of an interview composed of open ended questions based on sports imagery literature and the deliberate practice framework was used. The interview was pilot tested on a national level heptathlete who was not a study participant. The interviews were analyzed using the QSR Non-numerical, Unstructured Data, Indexing, Searching, and Theorizing computer program. In addition, participants completed the quantitative measure, the Sport Imagery Questionnaire. The athletes were asked a week before the interview to reflect on their use and opinion of mental imagery. The interviews took place either at a national training camp or at the home of the athlete. The interviewer was a heptathlete who was experienced in qualitative research. Interviews lasted approximately 40 minutes each, were tape recorded and transcribed. The SIQ was administered to support and verify information gleaned from the interviews. Descriptive statistics found that in descending order, heptathletes most frequently used imagery as follows: motivational general-arousal (mean of 4.92, SD of .58), motivational general-mastery (mean of 4.67, SD of .98), cognitive specific (mean of 4.47, SD of 1.19), cognitive general (mean of 4.19, SD of .81), and motivational specific (mean of 3.08, SD of .78). These are the only statistics reported. Other data is narrative from the interviews. The combination of qualitative and quantitative data found that imagery varied as a result of four main factors – relevance, quality, temporal factors and mental state. Images were most effective when related to the present moment, included multiple senses (including kinesthetic), had a rhythm, focused on a few key aspects of performance, were controlled well by the heptathlete, and were more effective for field events as opposed to running events in the heptathlon. The athletes also found the use of imagery more useful in competition versus practice, and it was more effective when mood was positive. This is in keeping with other findings that mental imagery should be individualized for the athlete, should focus on the present rather than long term goals, should not include an overwhelming number of cues but focus on specifics, and should be well rehearsed. The fact that it was more effective when the mood was positive correlates with their primary use of motivation general-arousal which is used to regulate arousal and anxiety levels. The second most used type of imagery, motivation general-mastery, is associated with increasing self efficacy and maintaining a positive attitude. It is interesting that the least used is motivational specific, which is used to set process, performance and outcome goals. These types of goals are very important to athletic competition outcomes.

Peynircioglu, Thompson,& Tanielian(2000) found imagery to improve the task of shooting free throws in basketball, but to be of no use in increasing grip strength. When methods of instruction were reviewed, the authors concluded that performance can be enhanced using imagery but that the instructions should match the task taking into account the demands of the task and the strengths of different kinds of imaging.

Csikszentmihalyi (1990) described the concept of flow or “being in the zone”. Athletes strive for it, but are not able to make it happen at will. Csikszentmihalyi. (1990) found that there are common elements that enhance the possibility that flow will occur. These include a balance of challenges and skills, a complete absorption in the activity, clear goals, a merging of action and awareness (no thinking, just doing), total concentration on the task, loss of self-consciousness, a sense of control, rewards are intrinsic, time may speed up or slow down, and movement is effortless. Some athletes report that there is an alteration in perception such as the basketball hoop becoming so large that the shot cannot miss or even seeing the ball go through the hoop before it does. Flow states occur when the task and the individual’s ability are equal. If the task is too hard, the individual struggles. If it is too easy, the individual gets bored and loses interest. The flow state has qualities in common with the concepts of nirvana and enlightenment from Eastern traditions and in particular taiji chuan in which movements should be effortless and soft but also powerful like steel wrapped in cotton. Nicholls, Polman, and Holt (2005) examined whether imagery could affect the intensity and frequency of flow states in golf performance. The study consisted of four participants (three male and one female) who were described as high powered golfers, all at a national or university level of competition in England and all with a handicap of scratch or +1. Remarkably, none had prior imagery experience. This contrasted with their literature findings that golfers who use imagery practice more, set higher goals, have more realistic goals, and adhere to their training programs more than those golfers who use imagery less frequently. Using the Martin et al(1999) model, they hypothesized that in particular, three types of arousal would increase flow states. Motivational general-mastery focuses on having the skills and abilities to meet different challenges and increases self efficacy. One factor in the flow state is skills-balance or having the ability to meet the challenge and being confident of that. Motivational specific imagery would relate to specific goal achievement which should help with achieving flow. Motivational general-arousal imagery should reduce anxiety which would help set the conditions for flow to occur. Imagery scripts were specific to the individual golfers and each golfer's goals. The initial training was live and the live training was tape recorded with the tape given to the golfer with instructions to review it five times a week for the following two weeks. Prior to training the researchers obtained baseline measures for each golfer. The intensity and frequency of flow was measured for each person after each round of golf. Intensity was measured by the Flow State Scale-2 and the frequency was measured by Dispositional Flow Scale-2. There were increases in global flow frequency for all for golfers following imagery training. Three out of four showed an increase in flow intensity. The overall increase in the magnitude of intensity and frequency was low, but the authors feel that since "small alterations in behavior could have dramatic effects on success for the population under investigation, we would suggest that the results of the present study indicate that the strategic use of psychological skills training may increase personal control over the flow experience." (Nicholls et al, 2005, p. 16)

Martin et al (1999) also theorized that the specific imagery types would be useful in rehabilitation from injury. Cupal & Brewer (2001) examined the effects of relaxation and guided imagery on knee strength, reinjury anxiety, and pain following surgery to reconstruct the anterior cruciate ligament (ACL). Injury is a constant possibility for athletes and recovery from injury has psychological as well as physical components. Acute tearing of the ACL is one of the more common recreation related injuries according to the authors. Thirty individuals participated in the study with ten each in control, placebo and treatment groups. The treatment group received ten individual sessions of relaxation and guided imagery in addition to the usual follow up therapy, with sessions two weeks apart over a six month period. They were also to listen to tapes once a day, but on average actually listened to them about four times a week. The control group followed the normal course of follow up therapy. The placebo group was asked to spend ten to fifteen minutes a day visualizing a peaceful scene and received attention, encouragement and support. They received about as much extra time as the treatment group for interventions beyond the control group norm. The treatment group had significantly better outcomes for increase in knee strength and reduction in pain and for concern about reinjury than both the placebo and the control groups. Guided imagery gave more constructive results than relaxing visualizations alone.

Two studies which do not involve athletics warrant mention concerning behavioral change. Peirce (2001) used imagery rehearsal treatment (IRT) to work with a ten year old boy who suffered from nightmares. The child, “Tim”, was diagnosed with psychotic disorder NOS, autism, possible traumatic distress disorder, mild to moderate mental retardation, possible cerebral palsy and static encephalopathy, a severe history of stressors including abuse, multiple placements, and problems with primary supports. His global assessment of functioning was rated at 25. At the time of treatment he was on Seroquel and Depakote. He had been tried on Risperdal, Geodon, Zyprexa, Abilify, Zoloft, Concerta, and clonodine. He was hospitalized due to increased aggressive behaviors towards his foster parents, psychotic like symptoms with fears and hallucinations and obsessive behaviors, strange perseverations, and fears. His therapist was Peirce, who reported that they quickly bonded. Tim asked Peirce for help with dreams about his past. The breadth of the dreams was such that Peirce felt that systematic desensitization would not work. He tried techniques which included “a combination of environmental adjustment, meditative techniques, and guided imagery before bedtime.” (Peirce, 2001, p. 283) When these did not work, Peirce used IRT with the instruction that Tim change the ending of his dreams. This is akin to solution focused techniques in which individuals are invited to use their imagination and resiliency to see alternatives to the way things are. With some instruction, Tim was able to come up with alternative positive endings to the nightmares. Improvement was seen after the first session, and the incidence of nightmares began to lessen almost at once. Tim was able to begin to devise alternate endings on his own. Despite his problems, Tim was able to devise his own imagery with Peirce’s help, and became more independent in devising positive imagery as he became more practiced at it. This indicates at least two things. First the relationship between the counselor and the client is of the utmost importance in change. Second, clients have great inner strength that should be respected, and the person should have a say in how they are treated. Any and every treatment should be individualized.

The second case involves the treatment of visual inattention in persons who have had strokes. The technique involves both imagery and modeling. Niemeier (1998) devised the “lighthouse strategy” to help with attentional focus. She based this on the fact that imagery had long been used in rehabilitation to teach compensatory skills to persons with memory and cognitive deficits, whether brain injury was a factor or not. Teaching with imagery improved both recall and recognition where as teaching only verbal strategies without the use of imagery only improved recall. Some individuals, due to the nature of their injuries, age, etc., had trouble creating their own images. The persons in the study were patients who were hospitalized due to stroke and who had attentional deficits or unilateral neglect. Unilateral neglect was first described by Bisiach, & Luzzatti (1978) who found that some brain damaged people ignored the left or right portions of their visual fields and also ignored the left or right portions of their imagery. The object of the lighthouse strategy was to help them remember to scan both left and right. There was a control group who were not exposed to the lighthouse strategy. Part of the treatment involved showing a line drawing of a lighthouse to the experimental group individuals and helping them to scan stimuli both left and right as a lighthouse beacon scans and counting what was missed. As reinforcement, persons were shown how much better they did as the number of trials increased. Posters of the lighthouse were displayed where the group could see them and were also given to their treatment team members and family. Those persons treated with the lighthouse strategy increased their ability to attend to their left or right and improved their attentional abilities. Neimeier (1998, p. 403) went on to say that “images provided by the therapist have been shown to allow more impaired, right hemisphere stroke, distractible or older patients to benefit from the use of visual imagery in cognitive remediation when they have not done so in other such treatment.” Interestingly, one individual had been diagnosed with attention deficit disorder and had been on Ritalin prior to the stroke. This individual improved in attention skills using this cognitive attentional strategy. Neimeier (1998) theorized that part of the improvement might be due to a change in self perception by those in the experimental group. Despite the fact that the image was provided from the outside, the participants were encouraged to internalize the image, to blend with it, to in essence, become the lighthouse. They had control.

Sklare (n.d.) proposed a group solution focused guided imagery exercise which could be used in a class room setting to help students with problem solving. Imagery is used to help with setting achievable concrete observable goals and behaviors with the emphasis on action versus coming up with things that the individual will not be doing. The individual also visualizes what differences others would note about the person when the change takes place or even begins to take place. As yet, there is no research data on the effectiveness of this particular strategy.

One of the more intriguing studies involved the use of imagery to increase physical strength. Shackell & Standing (2007) compared three groups of male undergraduate athletes on gain in strength in hip flexion. One group received weight training, a second group received mental imagery training with the imagery equivalent to the actual weight training, and the third group received no training. Both the training groups experienced comparable strength gains as compared to controls. Both the training groups experienced a reduction in resting heart rate as well. The authors conclude that this phenomenon occurs due to the oneness of the mind and the body/brain. Thinking is a brain process which has an effect on other processes of the body. This concurs with Armstrong's central state materialism theory which Smart (2007) summarizes as experiences being brain processes. Experience is not some separate entity correlated with or separate from brain processes. The experience and the brain process are one.

How does imagery work in the brain?

Most of the research done on imagery has been confined to visual imagery. Thomas (2007) gives an excellent overview of the study of imagery by Western psychologists and philosophers. Just trying to define imagery or to even accept its existence has proved problematic and subject to long term disagreement and debate.

Behaviorism, particularly its founder John Watson, denied its existence and found that something so introspective and subjective was not a topic that lent itself suitable to scientific research. One issue as well is picture theory, that the images in the brain are picture like in quality. Cognitive psychologists counter that the images perhaps should not be seen as subjective experiences, but as sort of underlying representations in the same way that gravity is an underlying unobservable reality. With this definition, the problem of the experience of whether we are thinking in pictures is thought to be resolved. It also allows for the other types of imagery – tactile, auditory, kinesthetic, etc. Thomas (2007) goes on to suggest that in research, it would be helpful to differentiate between imagery experiences or quasi experiences (which are only in the imagination) on the one hand and imagery representations or processes (the physical mechanics of how images come to be) on the other. Even with that distinction, there is the difficulty of differentiating between imagery (what I imagine) and perception (what I actually see) at a neuronal/brain level. The author points out that one commonly accepted difference is that imagery is under our will, whereas perception is not. However, one could argue that based at least on imagery work with athletes, there are times when imagery seemingly is not under conscious control, such as when an athlete becomes distressed if the image does not follow the prescribed flow. For example, a diver who is about to compete tries to image the dive done perfectly before stepping onto the platform, but the imagery envisioned has the individual hitting the board. One of the key factors in imagery for enhancing performance is controllability of the image. (Weinberg & Gould, 2007)

Noe, Pessoa, and Thompson (2000) point out that we are not yet exactly sure how vision itself functions, let alone imagery. They examine the phenomenon of "change blindness" in which individuals fail to notice obvious changes in the environment.

Theoretically people take in information visually and reconstruct it in detail in the brain. This occurs despite a blind spot in each retina where the nerves to the brain connect at the back of the eye, that the eye is nearly constantly in motion, that the retina does not have a high resolution for either spatial or color imagery, and that when the image gets to the brain, it is inverted. The brain takes all this information and puts together what we see. One could use the metaphor of hypertext markup language for the World Wide Web. The image that we see on the screen gives little evidence of the underlying code that causes that image to come to be via programmed instructions. Based on investigations of "filling in" (we see a scene and fill in missed details with our brain), perceived stability in vision despite fairly constant eye movement, and change blindness, Noe, Pessoa, and Thompson (2000, p. 104) propose that "the neural bases of vision may not require elaborate world-model construction" and that the traditional reconstructionist conception (the brain putting together the scene much as a web browser uses code to construct a web page) of vision should be rejected. Blain (2006) was able to create a computer model of imagery based on perceptual activity theory (which sees imagery more as guided exploratory activities rather than internal representations of constructs) and sensorimotor contingency (variabilities in the environment noticed perceptually) theory, which he says rejects the assumption of imagery as internal representations or structures.

Kosslyn, Ganis, & Thompson (2001) use various types of brain imaging – positron emission tomography (PET), functional magnetic resonance imaging (fMRI) and single photon emission computed tomography (SPECT) – to study areas of the brain activated by various tasks. They also study the effects of various types of brain damage to see changes in outcomes of behavior. They also use transcranial magnetic stimulation (TMS) to use a magnetic field to temporarily disrupt specific neural activity in the brain to study effects. They report that mental imagery uses much of the same portion of the brain as the same mode of perception. Visual imagery uses the same neuronal substrates as actual seeing, auditory as hearing, etc, and that the same areas used in memory, emotion and motor control are activated by imagery as by actual experience. They found that some research reported that when an individual lost the ability to perceive in a certain way, often a like deficit would occur in imagery. A person with a stroke losing the ability to see to the right visual field may lose the ability to image to the right or an individual losing sight also losing the ability to visually image. However this is not always the case and there is an idiosyncratic element. Some persons who can visualize may have sight deficits and vice versa. Kosslyn and Thompson (2003) reported that damage to specific areas of the visual cortex can result in blind spots in vision and in imagery that are localized according to where the damage occurs. Kosslyn et all (2001) assert that imagery uses low level organizational processing in the brain, while seeing does not require the activation of memory when perception occurs. Results of studies of brain damaged individuals indicate that there is an overlap of about two thirds of the same brain area activated whether the task is seeing or imaging. The differences in deficits vis a vis imagery and perception may be due to damage to areas specific to each function. They postulate that imagery is not one unified function, but a “collection of abilities, which can be disrupted independently” (p. 636). This carried over into auditory imagery. Persons with lesions in the right hemisphere had trouble with the level of pitch of well known song lyrics whether they heard the song or had to image it internally.

Kosslyn et al (2001) went on to describe how, at least in monkeys, the same neurons (in the F5 part of the premotor cortex) are stimulated by movement, for example of the hands or mouth. These same neurons are stimulated when the monkey observes another monkey or human make the same movements. This usage of the same neurons for movement whether activated or observed could help explain part of the structure for learning from modeling and how imagery, which engages the same motor neurons, can improve performance. Kosslyn et al (2001) point out that the visual area of the brain, areas 17 and 18 of the early visual cortex, receive information from the retina and are topographically organized according to the spatial geometry of the retina. An analogy might be thought of as roughly the area on the mirror in a traditional single lens reflex camera being about the same size and shape as the film where the image arrives and is captured. Unlike the camera, if imagery happens in the same area as vision, then we have the ability to alter the picture based on beliefs and expectations, which could explain the bias towards normalcy in perception and call into question the accuracy of eye witnesses. Further experiments found that when persons had their eyes closed and were asked to visualize specific items, area 17 was activated. The area was not activated when similar auditory cues were used. Additionally, the cortical area activated varied according to the size or the shape of the visualized object and rotating the object shifted areas activated in the cortex. When participants were asked to scan the object, the activation areas moved. TMS was used to disrupt area 17 for individuals either actually seeing a picture of stripes or imaging them, and both groups had similar trouble describing differences in stripes whether seen or imaged. Kosslyn (2005) theorizes a visualizing processing system for imagery in which information comes in to the brain, goes into attention and is then directed to a visual buffer which also contains an attention window. Information may also come directly into the visual buffer. The visual buffer then sends the information to a spatial properties processing area and an object properties processing area. These two processing areas then send the information to an associative memories area. Stored memories play a crucial role in imagery. Introspection plays a critical role as well. When asked to remember where you left your keys, you may visualize your steps and where you were moving up to when you last had those keys. Based on primate research, Kosslyn (2005) asserts that about half of the area of the cortex related to vision is topographically organized, and this is the area in which the “visual buffer” is located. The buffer is where the raw data of visual images congregates whether internally or externally created. It organizes by color, shape, figure, background, etc. The attention window selects what to focus on from this mass of data. This area allows you to scan imagery without having to move your eyes. When the data is selected for viewing, it is sent to two locations – the inferior temporal lobe and the posterior parietal lobe. The former is the object properties processing system (shape color, texture) and the latter is the spatial properties processing system (the relative position in space of the objects to each other).Spatial relations are a higher order than shape. Shape is a function of the coded spatial data and is a necessary condition for shape, but the reverse is not true. Again, it may be useful to think of this using the World Wide Web as an analogy. You type in a universal resource locator (URL) address into your web browser and key “enter.” The browser shifts into attention mode – there is something to be retrieved (imaged). It sends a request via your Internet service provider out to the Internet backbone which translates the URL into the assigned numerical address of the computer on the network where the data you want is stored. It is a highly specific request. Type in a wrong letter and you will not get the file you are requesting. You are directing your focus of attention. If you typed the address in correctly, the computer where the file/data you requested is stored sends the data back to your computer in packets. Those packets are split up and travel over various parts of the network, each trying to find the most efficient way to travel. They arrive at your computer and your browser has to decode the language to display the file. Your hard drive's temporary internet files are now like the visual buffer with a mass of data to be interpreted. Other data is already stored there (associative memories) and if you have visited this site before and you have not set your browser to see if there are differences between now and when you last looked, your attention window may direct you to that already viewed file and you will see the old version (similar to change blindness). If a file is corrupted, there may be blind spots in the page or the page may not appear at all. The browser has to set up the page based on the code and some parts of the page may be text, some may be movies, and some may be other types of files. This is similar to the spatial and object properties parts of the visual system putting together input to form an image. Different browsers (Internet Explorer, FireFox, Opera, Safari and others) may take the exact same data and code and display it in different ways, just as some people see colors in different ways or interpret an image in very different ways.

As to how images come to fruition, Kosslyn (2005) says that they are constructed rather than stored in long term memory. Images in the buffer are created by "activating stored memories in such a way that the implicit shape information is 'unpacked'" (p. 337). The neuronal connections between the higher and lower parts of the brain associated with imagery run both ways – up and down – in these topographically organized areas. He also states that different types of memories are stored in different areas of the brain complete with cross-indexing that is two-way and associative. As one area realizes that another area may be needed in processing, that area is "primed" for readiness. Again, this is similar to a web browser which may download information in the background while you are performing one task so that when you click on the "primed" hyperlink, the file has already been downloaded and you do not have to wait. Kosslyn

(2005) also asserted that larger objects imaged tended to activate larger areas of the visual cortex, just as a larger size file will take up more space on a computer hard drive, will require more random access memory when activated, and possibly more screen size when displayed. He goes on to say that there may be more than one way that imagery is displayed mentally and that mental tasks such as object rotation in the mind may use different processes at different times. He does once again emphasize area 17 in visual imagery. Those persons who had damage in that area of the brain had greater difficulty forming sharp images, and those with reduced blood flow to area 17 were slower in forming images.

Kosslyn et al (2001) further described how the amygdala is involved from an emotional aspect in perception and imagery. Seeing something and visualizing it have similar effects on the body. When humans see something threatening, their heart rate, breathing, blood pressure and skin conductance all increase. The same thing happens when individuals visualize the same threatening scene. “Mental images of aversive stimuli activate the anterior insula, the principal cortical site of feedback from the autonomic nervous system” (p. 641). Kosslyn et al (2001) conclude that imagery engages the motor system and affects the body much as actual experience does. Perhaps this neuronal system is how those in the study of Shackell & Standing (2007) were able to increase muscular strength with imagery about as much as those lifting weights. Imaging activated the same motor pathways and fired receptors in the same muscles that would have been worked had they been actually lifting.

Shepard & Cooper (1992) asked three groups of people to rate the similarity of named colors and perform multidimensional scaling on their ratings. The three groups consisted of one group of individuals with normal vision, one who were color blind, and one made up of individuals who were congenitally blind. The ratings of the normal vision and the color blind persons were similar except when asked to rate actual representations of color. The blind were able to give ratings similar to a color wheel. All had conceptualizations of color which were similar, though at least two of the groups had no actual experience of color. This indicates that at least one method of storing imagery may actually be the verbal descriptions or coding that we give to them. This is similar to perceptual anticipation theory as described by Kosslyn and Thompson (2003) in which memories of shapes are stored in abstract code in the inferior temporal lobes. The visual cortex is connected to this area of the brain and uses the code to construct the shape. Spatial representations, such as those used for reaching or navigation, are stored topographically in the posterior parietal cortex and are not directly associated with the visual cortex. According to the perceptual anticipation theory (Kosslyn and Thompson, 2003) we use the mechanisms to generate imagery that rely on anticipating the perception of a sought stimulus. We anticipate seeing a rabbit and immediately call up the coding needed to visualize a rabbit, whether one is actually present to be seen or not. Once the image is called up, we can then change it around in our imagery. They also found in a review of studies that the need to use high resolution to look for details in imagery, such as being asked to rotate an object in imagery, activated the early visual cortex. The early visual cortex is not activated in spatial imaging, and the cortex is de-activated when one switches from shape-based to spatial based imagery tasks, and the ability to use shape based imagery is negatively correlated with the ability to use spatial based imagery. Persons with high spatial ability use more schematic type images rather than depictive images. It would make sense, then, when analyzing an individual’s imaging ability that this should be taken into account. When developing imagery to help enhance performance, you need to listen to feedback from the individual as to what and how they are imaging and work with that. Training may help increase ability in deficit areas of imagery ability. Kosslyn and Thompson (2003) lastly point out the relationship between imagery and attentional mechanism, that attention may at least in part give rise to imagery.

Fletcher, Shallice, Frith, Frackowiak, and Dolan (1996) examined brain activity during memory retrieval and the effect of imagery and semantic cuing. Specifically they looked at long term memories which had a spatiotemporal reference or episodic memories. Many areas of the brain were found to be involved with retrieval of this type – medial temporal lobes, diencephalic structures, frontal lobes, basal forebrain and others. The authors hypothesized that the precuneus area is involved in visual imagery retrieval. Each participant was given lists of "imagable" and "non-imagable" words. Imagable words were those which are related to something that can be seen, such as a car, a dog, etc. Non-imagable words were more abstract terms or thought to have no ability to have an image attached, such as go, close, far, etc. One confound the authors had was that some individuals will attach an image even to words considered non-imagable. Again, the style of thinking and learning of the individual comes into play. To try to control for this, the authors had the participants rate the strength of any image they associated with any of the words. Participants were presented with pairs of words for recall. The words could be semantically close imagable pairs, such as "King-Queen" or semantically close non-imagable pairs such as "Near-Close" or semantically distant imagable pairs, such as "Arm-Muscle" or semantically distant non-imagable pairs, such as "Love-Happiness" or semantically unrelated imagable pairs, such as "Puppy-Hurricane" or semantically unrelated non-imagable pairs such as "Secure-Irony". Participants received a PET scan during recall. Participants were given the first word of the pair and asked to recall the second word. In terms of recall, there was no significant difference as to imagery or non-imagery or semantic distance. There were differences in terms of which parts of the brain were active during recall, and the area of the brain activated during recall was the precuneus. The greatest responses of the brain were to highly imagable concrete words. The authors concluded that the precuneus is required for conscious visual imagery. The early visual cortex was not activated in recall, which led Fletcher et al (1996) to believe that memory based imagery uses higher visual processing areas. For non-imagable words, the left lateral prefrontal cortex was activated. The authors speculate that non-imagable words are more difficult to recall because they may require deeper processing.

Imagery also affects the encoding of motor movements into the neural system, and there is a relationship between the visual and the motor systems. Jeannerod (1994) reports that there is a close functional equivalent between motor imagery and motor learning in the neural and physiological structures involved, and this functions separately from other simultaneous tasks such as recognition. Further, the author posits that actions are driven by internal represented goals. Actions are built in steps in a system with fixed rules. There may well be separate verbal and nonverbal neural systems in the brain both involved in action.

Jeannerod (1994) accepts Kosslyn's picture oriented theory backed by research which finds that when individuals are asked to mentally scan between landmarks on a memorized map, the scanning time between points of the imaged map is directly correlated to the scanning time required for the actual map. Jeannerod explains this as being due to the processing of the map's image on the retina corresponding to the image sent from the retina to the topographical visual cortex area. Since blind individuals still have spatial neural capabilities, the blind also have similar spatial capabilities in imagery. Think of the blind golfer imaging where the cup is when putting. Jeannerod (1994) theorizes that for visual imagery, there may be separate systems for internally produced images and the external images which we see, and that there is a part of the brain where the two systems merge, possibly the posterior part of the left hemisphere. He generalizes the visualization modalities to motor imagery. Visual imagery is related to and produces motor imagery.

Motor imagery and motor preparation are assigned to the same neural structure. Despite being a different structure from visually imagery, it is difficult to separate the two since imagined actions may take place in the visual imaging realm. Motor imagery is more internal imagery – first person imagery or feeling it through your own body – as opposed to external imagery or watching as if you are a camera outside yourself. You send movement signals to your muscles with internal imagery, but not so much, if at all, when using external imagery. It would be interesting to do a follow up study of Shackell & Standing (2007) which used internal imagery to increase muscular strength but instead to see if external imagery had any effect. One would guess that it would not. Indeed, in a review of the literature on similar studies Jeannerod (1994) found that mental training improved strength, but that the muscles themselves did not express electrical activity similar to that of actual weight lifting. If there was increased activity, it was across overall musculature in the body rather than in the isolated targeted group. The strength increase possibly occurs at the neural level with changes in the execution level of the motor system if the spinal circuitry. External imagery is more akin to modeling and is useful for learning movement tasks. The same neuronal system used for perception of the task would be used in performance of the task. The difference would be in the lack of activation of even microscopic movement while just watching. Jeannerod (1994) further differentiates between motor movement and motor preparation. Movement preparation is not always, perhaps not usually, under conscious control. In fact, he says it is totally outside of conscious awareness – awareness only occurs when you are left to decide whether the action taken was the appropriate one. Motor imagery is under conscious control. He feels that when motor preparation is prolonged, it becomes motor imagery. This makes sense from the point of view of flow. When the athlete has to think about the movement, such as the golf swing, performance suffers. However, to learn the movement, the golfer may learn the swing in progressive steps of small movements and at a very slow speed. As the task becomes internalized in motor memory and muscle memory, there is less imaging, less preparation for movement, and more doing. With flow, the motor preparation and action are done effortlessly and without thought. To stop to think would make the action more difficult and more self conscious and would take the individual out of flow.

Kosslyn & Thompson (2003) point out that there are problems in comparing various studies on brain activation. The different types of scans (PET, fMRI, SPECT) have different sensitivities to neuronal activity. Some studies also measure blood flow to various brain parts rather than electrical activity. Similar problems arise when measuring muscular activity. As stated above, Jeannerod (1994) speculated on neuronal systemic changes that increased muscular strength rather than muscle activation during imagery. He did propose an alternative that coincides with that theory. As there can be issues with how and where brain activity is measured, likewise there can be issues with sensitivity of machines that measure muscle activity. Mellah, Rispal-Padel, & Riviere (1990) did find muscle activity during the preparation stage for movement, but it occurred in deep muscles whose fibers have a low metabolic rate and whose activity would escape detection by the standard measures taken during studies which tend to focus on surface muscles with equipment geared for surface detection. Again, a sort of priming for action may be taking place at a deep level in the musculature which would have an effect on strength. Jeannerod (1994) further found priming in the cardio-vascular system in imagery associated with the preparation for motor action.

Jeannerod (1994) also examined the time involved in imagined motion versus actual motion. A variety of tasks examined by researchers found a strong correlation between the time taken to imagine a task and the time taken to actually perform it. This included such seemingly unrelated items as reciting the alphabet, reciting number series, and walking from one point to another on a memorized layout (similar to the scanning of the memorized map mentioned early except there was actual movement as individuals walked in the non-imagery phase). Ozel, Larue, & Dosseville (2004) compared two groups of persons over three tasks involving time and imagery. The first task involved participants estimating when a ten second interval had passed by starting and stopping a stop watch. The second task was to walk a specified distance self timing the elapsed time to complete the task by using a stop watch. The third task was to mentally image the same walking task and time it using a stop watch. These tasks were performed under two conditions – quiet and noisy. Stressful noise (sounds of sub-machine guns, fighting, and motor cross) was introduced (through stereophonic headphones) to measure the effect on participants' internal clock by increasing arousal, with arousal having an increasing effect on the internal clock. Despite the heightened arousal, the times for real and imagined walking were correlated. This led the authors to conclude that both real and imagined walking share a common cognitive process where the internal clock is concerned. Two participants were dropped when they were unable to imagine walking by any means and merely counted footsteps. Two others were dropped because the noise made it impossible for them to concentrate at all.

Pylyshyn (2003) would argue that pictorial imaging did not take place in these studies. He finds fault with imagery research which espouses the pictorial theory, i.e., we visualize in pictures. He feels that "nearly all experimental findings cited in support of the picture theory can be more naturally explained by the hypothesis that when asked to imagine something, people ask themselves what it would be like to see it, and they simulate as many aspects of this staged event as they can and as seem relevant" (p. 113). He makes no assumptions about the format the individual uses for the simulation. For a scanning process, he feels the person conceptualizes how the object being scanned would look if actually seen. He thinks the scanning has nothing to do with the format per se, but how the person understands the task. Pylyshyn (2003) cited a mapping exercise which not only included visually scanning from one point to another (which replicated the time in prior similar studies) but had lights at various locations on the map. An individual would focus on one point on the map, then was told that a light went on at a second point and to focus there, and to get an orientation of the first point from the second. The time correlation in movement disappeared when the task was presented this way. Based on that finding, Pylyshyn concluded that scanning is not solely done by imaging a picture. Jeannerod (1994) also looked at work that would seem to counter the picture theory. Blindfolded individuals were timed walking from one point to another and were instructed to imagine walking between those two same points. There was a correlation of time. The same thing was done again except this time, individuals were given a 25 kg. load to carry. The individuals were also supposed to carry the weight in the imagined sequence. The time to actually walk was about the same with or without the weight. The imagined time, however, resulted in individuals taking a significantly longer time to carry the load in their imagination than it took to actually walk the distance. This could be due to reasoning as Pylyshyn would theorize. Jeannerod (1994) theorizes that time is not the variable that is being used in the imagination, but force. When carrying the load in reality, intentional processes took load into account and maintained speed. Since the imaging individuals had not encoded the increased force needed to maintain speed into their script, it was not taken into account in the imaging and the time was longer.

One area for which no research could be found was the possibility that the imagery used in reasoning might be auditory – individuals "talking to themselves" in the mind instead of visualizing in the mind when imaging. Studies could focus on the auditory parts of the brain for those individuals who cannot see in pictures and try to determine if there are similar brain activities there when asked to image as occurs in the visual areas of the brain for visual imagers. Imagery would be seen as consciously directed thinking with pictures or words in these types of studies.

For Jeannerod (1994), encoding is a central theme. Skilled movements take place in a process that is encoded in the brain as hierarchical schemata which work together, such as visual and motor working together for action, with goals being an integral part. It is difficult to tell where one process begins and the other ends and there may or may not be overlapping. Porro, Cettolo, Francescato, & Baraldi (2000) found evidence of overlapping neural networks in the motor and pre-motor cortex for tasks involving imagery and the execution of simple motor tasks, and they suggest that motor networks may be recruited by conscious representation so that imagery could be used in neurological rehabilitation.

Similar to schemata, Wohldmann, Healy, and Bourne (2007) found a process called “chunking” in skills acquisition and maintenance. The task was typing skills for eighty novice undergraduate typists using imagery or actual practice for skill acquisition. Initiation time and execution time were measured with the theory that initiation time would take the longest part of response. Execution time was measured on keystrokes subsequent to the first keystroke. They found that “mental practice was adequate to produce or maintain a level of skill comparable with that of physical practice” (p. 259). Chunking is the encoding of two or more digits (in the typing of a learned set of numbers) and is similar to buffering in terms of preparation. Chunking may add to initiation time, but speeds up subsequent execution time. “Mental practice may work by activating and strengthening representations formed previously by physical practice” as well (p. 254).

At times these systems break down. Lhermitte (1983) examined a group of individuals who had damage to the prefrontal cortex. The individuals compulsively imitated actions performed in front of them. When given a glass and a bottle of water, they compulsively poured water into the glass and drank. Possibly the prefrontal cortex is part of the system that inhibits motor action. Any motor imagery or modeling that occurs is immediately put into action by the persons.

Damage to the cerebellum results in both slower actual motor performance of the hands as well as slower imaged performance with the hands according to Gonzales, Rodriguez, Ramirez, and Sabate (2005). Their study compared eleven persons who had suffered but ostensibly recovered from stoke causing damage to the cerebellum to eleven non-damaged individuals. The authors looked at motor control as consisting of two systems or mechanisms. One is the executive motor function (EMF, which involves the cerebellum). The other is non executive motor functioning tasks (NoEMF) which involve planning and internal simulation of movements needed to predict consequences of possible behaviors. Mental imagery of complex finger movement sequences as well as actual movement tasks were used to evaluate the use of the cerebellum in motor tasks. The individuals with stroke were slower in both actual and imaging tasks. Damage to the cerebellum delayed not only initiation of tasks but of the execution of tasks in actuality and in imagery leading the authors to propose that the cerebellum is involved in both executive and non-executive functioning.

Sirigu & Duhamel (2001) took a closer look at the neural networks associated with visual and motor imagery by studying persons with damage to the brain areas associated with visual or motor imagery and people without damage. The task for persons without damage involved hand rotation with two variables – the hands were placed either on the lap or behind the back (out of vision) and the instructions were either first person or third person. Participants performed the hand rotations with eyes closed in both the real and the imagined conditions. First person instructions were for the person to "visualize your hand" and in third person were to "visualize my hand" or the researcher's hand. For those without damage, the response time with hands on the lap was significantly faster with first person instructions than third person instructions. For hands behind the back, the exact opposite occurred – response time was significantly faster for third person instructions as opposed to first person instructions. The authors hypothesize that there must be two different systems at play for this to occur. When questioned, the participants said that with first person instructions, the hands on the lap situation felt more natural and enabled task completion. Hands behind the back felt awkward, even though their eyes were closed. In the third person instructions, the participants said that having their hands out of the way made it easier for them to visualize the researcher's hands, even though their eyes were closed. The authors feel that different mechanisms are at work in first and third person tasks. First person instructions involved motor activation while third person imagery might use non-motor activation. One could also theorize that spatial processing is utilized, and it could be seen as lending support to Pylyshyn's theory that it is reasoning that is utilized in visualization rather than innate picture formatting.

The individuals in the study with damage included one individual with a left parietal lobe tumor (who had limb apraxia and motor imagery impairment) and one with bilateral damage to the inferotemporal structures (who had no visual impairment but who could not visualize the shapes of objects and faces). The results of tasks were compared with a group of twelve individuals with no damage. As expected the individual with parietal damage had a great deal of trouble with imagery tasks concerning finger movement. The person with inferotemporal structural damage was able to complete the task and reported kinesthetic awareness despite only being able to visualize his hand as a "kind of stick" (p. 913). Visual imagery tasks included identifying the color of named objects, categorizing named objects by shape, categorizing named objects by a semantic attribute, and mental rotation of shapes. The individual with the parietal lesion scored as well as or better than the mean of the non-damaged group on all tasks but the mental rotation. He was not tested on the latter. The individual with the inferotemporal lesion scored the same as those without damage on the categorization of named objects by semantic attributes, but was significantly (more than three standard deviations) below non-damaged individuals on the other tasks. He did score perfectly in the first person hands on the lap task, but deteriorated significantly with his hands behind his back, perhaps because he could not simulate with his hands in a spatially different place, which, the authors feel, supports the thought that visual imagery is associated with this motor task. The individual with the parietal lobe lesion used the same length of time to respond with his hands on his lap whether given instructions for hand rotation in first or third person. He did not imagine moving his hands in the task as others did, but just “saw” them at the final location. In the letter task, the individual with inferotemporal structural damage was able to recognize letters only when allowed to have micro-movements of his fingers – as though he were writing the letters in the air. He was able to recognize the shapes using kinesthetic awareness. The authors conclude that there is a coupling of the motor and visual processes which may take place in the parietal lobe. For first person mental rotation tasks, motor imagery is used while for third person rotational tasks, visual imagery is used. “Lesions causing visual imagery impairments selectively preserve mental rotation guided by motor imagery, while lesions causing motor imagery impairments selectively preserve performance guided by visual imagery” (p. 917).

The question of timing in imagery and actuality is explored in depth in a literature review by Guillot & Collett (2005). Thirty two studies performed between 1989 and 2002 concerning simulated movement duration in a variety of mostly athletic tasks were examined. They use the term “mental chronometry” to refer to the time taken for the nervous system to process information. Studies used motor, attentional, perceptual and psycholinguistic reaction times, mental calculation, and mental rotational methods. Persons with high imaging capabilities had a correlation between the time taken to image a task and the time taken to perform the task. This was not the case for those with poor imaging ability. One could also ask if the difference might be due to differing attentional skills.

Bolliet, Collet, & Dittmar. (2005) looked at preparation for action in twelve top level individuals in weightlifting. Physiological factors tracked were skin resistance, skin potential, superficial skin blood flow, superficial skin temperature, instantaneous heart rate, and instantaneous respiratory frequency. Deep muscle activity was not tracked. Participants were tracked during preparation of performance of the snatch, an Olympic weightlifting movement. Trials consisted of a baseline with eight actual attempts and ten imagined attempts with each attempt separated by sixty to ninety seconds of rest to prevent anticipation, habituation and a return to baseline physiological levels. The physical measures were defined as the attentional resources the individuals allocated for the lift whether actual or imagined. Bolliet et al (2005) found that the resources allocated were similar whether the lift was real or imagined which again suggests a common neural system for movement whether real or imagined. Skin resistance response was shorter and heart rate was lower for imagined preparation. The lessened skin resistance is correlated with less focused mental activity. The differential heart rate might also be related to attentional differences. It may be that it is more difficult to focus for an imagined lift than a real one. Attentional skills do have an impact on outcomes in studies of imagery.

Guillot & Collett (2005) also found evidence that mental practice leads to increased performance by allowing the individual to codify skill parts into “meaning cognitive units” (p. 11) apparently the equivalent of schemata. They also found that for “highly automatic movements, such as writing, reaching, and grasping” the duration of time whether in imagery or actual performance was highly correlated (p. 11). If persons had to imagine injury during the task, the times were not similar, as was the case with individuals who had to imagine carrying the 25 kg weights (Jeannrod, 1994). Overall, elite athletes are the most accurate with respect to accuracy and correlation of the time taken for an imagined task and the real task. Elite athletes most likely have much more practice at imagining than the average person. Less skilled athletes have more difficulty representing imaged movement than elites. One factor that plays into time and representation is the perceived difficulty of the task. Tasks thought to be easier take less time in imaging than in actual performance, and the reverse is true for tasks perceived to be more difficult. Imagery takes longer. Guikkot & Collet (2005) conclude that for complex skills, visualizing imagery is more important than the temporal part of the imagery experience, which makes sense. When one is trying to learn a task, more care is taken in visualizing the movements with time a much less relevant factor. As the task is learned and internalized, the timing for imagery completion and task completion should converge.

Biofeedback using EEG can be used with imagery to improve performance. Davis & Sime (2005) presented a case study of an intercollegiate baseball player who suffered a serious eye injury and whose play subsequently deteriorated after physical recovery. The authors theorized that since sport is primarily visual, the need for alertness and attentional focus on relevant visual tasks is critical for success. Physical coordination exercises, relaxation training, and imagery combined with EEG bio-feedback were used to increase balance and attentional focus on external stimuli (such as an approaching baseball while in the batter’s box). The player’s batting average improved to pre-injury levels. However, when the therapy ended, the player’s average eventually decreased. Dinglefelder (2008) reported studies that found that EEG biofeedback may be useful for athletes. For archers, an increase in alpha activity in the right hemisphere increased performance. An increase in left hemisphere activity decreased accuracy.

Guillot & Collet (2005) point out another problem with brain studies of imagery. The cerebral maps drawn of the brain are “static representations of the dynamic activity of the brain” (p. 17). To think of it with a pictorial metaphor, we are reviewing a movie and deciding the plot based on single frames of the film. They also found that the nature of the instructions given to imagers also has an impact on the imaging process in areas such as timing.

Huber & Krist (2004) weigh in on the reasoning versus picture debate with a study that involves eye movement and prediction of the time involved in object movement. The authors hypothesize that visualization can improve performance to a much greater degree than conceptual reasoning for the same task, and that visual imagery may just be a part of the overall imagery system. Eye movements may play a functional role in visual imagery. If the visual areas of the brain are topographical and in perception reproduce the image on the retina in the brain, and if the same system is used in mental visualization, then it would make sense that the eye would move in response to the mental image since information in the system runs both ways. The physical eye would track what is only being seen in the mind’s eye. A navigational metaphor might be that when one pilots an aircraft by sight, the person is using visual (pictorial) imagery. When socked in a cloud and flying on instruments, the pilot is using conceptual reasoning to visualize and “see” the surroundings. The pilot is the “eye”. In this particular study, individuals had to predict the duration of an object’s movement, the object being a ball leaving a surface horizontally and landing on the ground in a marked spot. This scenario was presented on a computer screen with a camera focused on the participants’ eyes to record tracking movements. The distance from the horizontal surface to the landing area was varied with three different distances over the course of the trials. Eye movement was compared to accuracy of tracking time. For the “actual” trial (production task), the ball actually fell from the surface to the landing spot and participants estimated the time lapse from start to completion. For the imaged trials (judgment task), the ball remained motionless on the surface and individuals estimated how long it would take from start to finish. Persons tracked more in the production task and frequent eye trackers were more accurate in estimating flight time than those who tracked less or not at all. For the judgment task, most individuals did not track but instead persons seemed to rely on their conceptual knowledge of flight time, leading the authors to differentiate between perceptual and conceptual knowledge and how each is used, and at least in this case, perceptual knowledge was more accurate than conceptual knowledge. In further study, Huber & Krist (2004) found that eye tracking was a part of mental tracking and flight times could be estimated without eye tracking. The critical factor was how the experiment was laid out and in the instructions, though those used to utilizing tracking found non-tracking to be more difficult. Another factor that makes comparing research in this area difficult is the different conceptualizations of the researchers, study designs, and study instructions.

Since information flows both ways in perceptual and imaging systems, and actual performance has an effect on perceived time of imagined performance, then perhaps the speed of the imagined performance would have an effect on the real performance. Louis, Guillot, Maton, Doyon, & Collet, (2008) examined this prospect by having twenty four students memorize sequences of movements, one for the upper body and one for the lower body. Participants had no prior experience with the specific sequences. Kinesthetic and visual imagery abilities were evaluated and controlled for using the Movement Imagery Questionnaire Revised. Baseline times for each individual were obtained by having them perform the movements ten times with no external instruction. Following the baselines, the participants were asked to perform the movements again, twice at a faster pace and twice at a slower pace. Participants were then assigned to one of three groups – a fast group, a slow group, and a control group. The fast group was asked to practice using imagery for a specified time at the faster pace, the slow group was asked to practice using imagery for a specified time at a slower pace, while the control group used the same amount of time to deal a deck of cards. Debriefings were used to be as sure as possible that directions were followed and to see the degree of imagery used by each person (ranging from no image to very clear image). The post test consisted of ten trials of the individuals again performing the routines. For both upper body and lower body sequences, the fast group performed significantly faster after imagery than both the controls and the slow group. The slow group did not differ significantly from the controls. The results were the same for the lower body. Overall visual imagery was easier for the participants than kinesthetic imagery. As for the slow group, they reported that as they learned the movements it became more and more difficult to perform them slowly. Speed of movement was more a conscious decision than a result of the speed of the imagery. If anything, the slower speed aided learning and increased speed of performance as the movements became more ingrained. Eversfield (2003) recommends slow movement when learning swimming, cycling and running techniques for triathletes. The slow movements allow proper form to be learned, practiced and internalized more efficiently.

Something often times overlooked in studies seems to be the equipotentiality and plasticity of the brain. There is evidence both for and against these concepts in imagery. Liu, Chan, Lee, & Hui-Chan (2004) present two case studies of individuals who had cerebral strokes whose task functioning was improved after three weeks of mental training with five tasks worked on each week. Tasks were basic activities of daily living such as hanging clothes, making the bed, preparing tea, doing laundry, etc., and performance before and after training was measured by the Functional Independence Measure. Improvement in functioning did occur, particularly in attentional tasks and sequential processing functions, but not in motor or cognitive functions. The authors felt that the major therapeutic effect was improved attention, planning and executive functions associated with rehearsal. In essence, the individuals were more mindful after imagery training.

At least one study did not find imagery useful in working with twenty four healthy college age males after forced limb disuse. With disuse, muscles begin to weaken and atrophy in a relatively short time. Changes also occur in the related central nervous system sites. Crews & Kamen (2006) tested whether imagery could reverse that effect based on other studies that found that strength could be increased by imagery alone. The twenty four students were divided into imagery and non-imagery groups. The motor task was finger abduction. Baselines for strength and for muscle potential and cortical potential were measured. On day two, arm casts were applied to restrict movement. Muscle and cortical measurements were taken each day for both groups and one group received imagery training. Measures indicated lowered strength and activity for both groups. The trial period was seven days. Imagery had no effect for maintaining strength or cortical or muscular activity. Disuse produced changes in both muscular and neural tissue. The authors state that the task had a low cognitive component and that future studies might explore imagery's effects on tasks involving both physical and cognitive realms. There was a possible confound in the study. The authors concede that the imagery group may not have had as much success in learning the task prior to being immobilized so as to enable them to accurately reproduce the task during imagery. They had a worse score on the task at day seven than the non-imagery group and this is consistent with poor learning. Practicing a task incorrectly will reduce performance. The outcome may have been a result of study design.

MacIver, Lloyd, Kelly, Roberts, & Nurmikko (2008) found that neuroplasticity could be reversed in working with a group of thirteen upper limb amputees who experienced phantom limb pain. The neuronal-cortical changes can tracked in the brain, but it is unclear why these brain changes cause phantom limb pain. There were two types of pain – constant and chronic attacks of pain of various time durations. Brain areas associated with the face and lips reorganized after arm amputation and “invaded” the area associated with the missing limb. Touching the face of an amputee could evoke a “feeling” in the missing limb. The authors thought that using imagery to stimulate the deafferented neurons associated with the missing limb could alter the brain’s re-organization. Treatment included both imagery and relaxation and a mindfulness body scanning meditation technique. Individuals were seen once a week for an hour session with forty minutes devoted to imagery and the rest of the time to debriefing. After the body scan, the individual was directed to focus on the missing limb and its sensations, for example imagine it resting on the sofa. Individuals were also given individualized compact disks with imagery directions they could practice at home. After three weeks, all were skilled in the imagery and relaxation techniques and they were encouraged to practice noticing sensations from the phantom limb on their own. A lip purse task was used to measure cortical activity for the face to hand activity brain area, and imagery of the missing limb task was used to measure hand to face activity areas. A control group received no intervention. Of the thirteen imagery participants, more than 50% reported pain reduction, especially with regard to exacerbated chronic pain. Six were free of exacerbated pain at study's end, two of three persons who had been taking analgesics were able to discontinue the medication, and one reduced the need for medication. Reduction in pain was correlated with changes in brain activation in areas of the face and arm/hand. Pain relief was "associated with a reduction in cortical reorganization" (p. 11).

Pearson, Tong, & Clifford (2008) report that imaging can actually bias perception. In one experiment, individuals were asked to imagine a green horizontal or vertical stripe pattern while looking at a blank screen. The participants were then fitted with goggles which presented a green striped pattern to one eye and a red striped pattern to the other. Such perception is called binocular rivalry – each eye seeing an independent scene – and normally the brain switches from one eye to the other so that you can perceive both, just not at the same time. Horizontal and vertical stripe patterns were used because of their strong representation in perception in the early visual cortex. The longer a person had imagined a green pattern, the more likely they were to see the green pattern, but not see the red. There was a similar effect on subsequent perception if the participants were shown a faint representation of one of the patterns instead of asking the person to imagine it. Even one instance of imagining something can bias later perception. Changing the angle of the actual images reduced the impact of the imagined image on perception. The authors speculate that this means that the impact and interaction of imaging with perception takes place in the early visual process. The authors also feel that this is supportive of pictorial theories of imagery versus the abstract reasoning theories.

Despite a wealth of research, the exact nature of how imaging works, or even how perception works, in the brain is still unresolved. The research and debate go on.

Visualization and imagery based language and culture – The East

In the United States and the West, methods such as qigong and taiji chuan (both originating in China) in healthcare are considered a part of complimentary and alternative medicine. Techniques are considered complimentary when they are used in conjunction with conventional Western techniques and considered alternative when they are used in lieu of Western methods. The National Center for Alternative and Complimentary Medicine (2007) states that between 36% and 62% (depending on which non-conventional methods are counted) of people in the United States utilize non-conventional methods of healing. They are more likely to be women, persons with higher educational levels, people who have been hospitalized within the past year, and former smokers (compared with those who smoke or who never smoked).

The Chinese written language is based on pictures (as opposed to an alphabet) and the saying, "a picture is worth a thousand words" comes from China (Watts & Huang, 1975). The characters that make up written Chinese language were originally pictures. The use of pictures as a form of written language is not unique. One need only look at the petroglyphs of Native Americans, the petroglyphs of Mt. Bego in the Alps and the hieroglyphics of ancient Egypt. The West uses a universal picture "language" for informational purposes as well. You may not know what is written on the street sign or the warning sign or the bathroom door, but you know from the shape of the sign and/or the picture on it what it means, all said without words or reasoning.

Another underlying difference between Eastern and Western reasoning is linearity. Western thought is linear while Eastern thought is more circular and holistic (Watts & Huang, 1975). The universe is, according to Watts & Huang (1975) "an infinitude of variables interacting simultaneously, so that it would take incalculable aeons to translate even one moment of its operation into linear, alphabetic language" (p. 6). The authors state that a language based on pictures may still be linear, after all, we communicate and perceive in linear time, but it is still more representative of the nonlinear dynamic of the world than an alphabetic language. Pictures represent patterns more precisely than words. The same pictogram may be pronounced seven different ways in various Chinese dialects, but if the persons see the ideogram, meaning is instantly known. The forms have remained essentially the same for 2,500 years. Written English has changed dramatically just over the past few hundred years as anyone today who reads Beowulf or the works of Chaucer or Shakespeare can attest. They state that reading Chinese is pattern recognition and nonlinear. Symbols may be the same for what English and other European languages would have individual verbs, nouns, pronouns, adjectives and adverbs. Parts of speech play much less role in Chinese than in English. An example given is when one is invited to an event. A Chinese response would be just the symbol which would be translated as "know." It means that the person knows about the invitation and may or may not show up. Linguistically the same grouping of symbols may be translated many different ways. Tone of voice determines the meaning of the word. Whereas in Western languages, individuals use hand and arm motions as "body language" to enhance meaning, in China, a person might sign an ideogram with a finger in the air or on the table. Purely linguistically, the Western debate as to whether we image with pictures or with reasoning might be considered meaningless, or at least more a function of Western language rather than the actual structure of imagery. In English, to know linguistically requires a knower and something that is known. Watts and Huang (1975) state that this is based on grammatical and linguistic rules and not existential rules. As they put it, "raining needs no rainer and clouding no clouder" (p. 11). An imaginational image needs an imager, but just what is that image? Does it come to being as a nonlinear dynamic picture or a linear string of word based reasonings? Or some combination of the two in varying degrees? How do we differentiate one part of experience from another? Are distinctions linguistic artifacts which bind how we think and perceive or are they “real”?

In Taoist Chinese thought, the world is seen as an organic and holistic process (Watts, 1997). The Tao is the un-namable, underlying process or unifier originator of everything, but is in no way a deity in the Western sense. The metaphor most often used is that of water and the principle most akin to “flowing with the Tao” is called “wu wei” which may be translated as “not forcing.” Water is weak (it cannot hold a form on its own), yet powerful. A tidal wave or storm surge wreaks havoc. Over time, its flow can carve out great canyons. It seeks the lower ground and finds a way around obstacles. It changes forms according to conditions (liquid, solid, vapor) but is underneath the same and can changes states when conditions change. A person “flowing with the Tao” lives in harmony with surroundings, sees without seeing, acts without acting – experiences the world as it is without intervening language and thought. It could be thought of as effortlessly surfing the perfect wave – becoming one with the wave. The condition is similar to Buddhist concepts of enlightenment and in many ways to Csikszentmihalyi’s concept of flow in athletics (Csikszentmihalyi, 1990). When fully flowing with Tao, one is in a state of “wu ji” which can be thought of as the original state, without dualism. Fundamental to Taoist thought are the concepts of yin and yang, dualistic opposites. Everything has yin and yang qualities to a degree. Yin are soft, dark, yielding and similar qualities while yang are hard, light, forceful qualities. The symbol for wu ji is a circle. The symbol for taiji (a philosophy as opposed to taiji chuan, a marital art) is the well known yin-yang symbol. When one looks closely at the symbol, one sees that there is a spot of light in the dark half and a spot of dark in the light half (Fung, 1948; Jou, 1983; Yang, J., 1997) This theory also includes five elements or phases (Wu Hsing – also translated as five activies of five agents or Wu Te, the five powers), seen as interacting and dynamic forces – Jin (metal, which yields and is modified), Mu (wood, which is crooked but straightens), Shui (water, which moistens and decends), Huo (fire, which flames and ascends) and Tu (earth or soil, which provides for sowing and reaping). These elements are related to each other for creation/destruction and closeness/fearfulness. Wood creates fire, fire creates earth from the ash, etc. Wood is close to water, water to metal, etc. Each element has a related direction, season, color, flavor, yin organ, yang organ, and sensory organ, meaning the eyes, ears, etc. Chinese physicians use the elements in healing practices (Yang, J, 1998; Fung, 1948; Jou, 1981). These concepts and much of Taoist and Chinese philosophy take their root from the I Ching, or Book of Changes. Hare (2008) states that the Book of Changes is traditionally thought to date back to 2838 BCE and the Emperor Fu Hsi. A full philosophical discussion of Taoist thought is beyond the scope of this paper, but the above forms a basis for a discussion of qigong and its use of imagery for healing and increasing athletic performance. Since language and thought processes in China are based on images, it makes sense that part of the healing power of qigong and taiji chuan is based on images.

Qi is energy, and there are many kinds of qi according to Chinese medicine. Heaven qi (Tian Qi) is the force which fills the universe and is also seeking balance. The weather in China is referred to as tian qi. Rain, tornadoes, hurricanes, etc, result as a consequence of qi out of balance. Earth qi (Di Qi) is ruled by heaven qi and is made up of lines and patterns of energy including the magnetic fields of the earth. One example of the seeking of balance in earth qi would be the pressure in a volcano building until there is an imbalance of energy and the volcano erupts releasing the excess energy. Within earth qi, every living thing has its own qi, also seeking balance. Illness is an imbalance or blockage of qi. In the human body in China, the human qi system exists along side the circulatory, nervous, and lymphatic systems, with qi flow and blood flow closely related. The Chinese character for qi consists of two characters, one above the other. The top character can be translated as "nothing" and the bottom as "fire." Qi is "no fire" or organs with proper qi and in balance are not overheated and on fire (Yang, J. 1997). Qi travels through the body in twelve channels (rivers or meridians) and is stored in eight vessels (reservoirs). There are points on the body where qi can be stimulated (acupressure points) and points where qi can flow into and out of the body, such as the ba hui (top of the head), qwa (groin), lao gong points in the palms, the bubbling well points on the bottom of the feet. Similar to chakras in Ayurvedic medicine and yoga, the body has three dan tiens in Chinese medicine, or "elixir fields" where qi can be generated and stored. One is about the middle of the forehead, one is near the solar plexus, and the third is three fingers below the navel and three finger widths inside the body(Yang, J. 1997). The lower dan tien is your center of gravity and Frantzis (2006) calls the lower dan tien the single most important energy gate in the body with "all energy lines to physical health and well-being located there" (p. 138).

Gong means any practice that takes energy and time, so qigong is training with qi which takes much effort and time. Qigong may be used for healing, for martial purposes and for enlightenment (Yang, J. 2007). Qigong involves movement of the body designed to move qi and to take in or dispel qi, to massage the internal organs, to stretch the body, and to regulate breathing and heart beat. In addition to body movement, sounds may be made which are thought to have specific healing properties for specific organs. Visualization is also a major part of qigong Metzger & Zhou, 1996). Yang, J. (2008) describes coming to be able to have awareness of internal organs and of inner qi flow. He began with visualizing the qi flow and after about three months, felt that he could feel the actual qi itself. The experience sounds similar to visualization healing methods described by Hall (2003) in the use of imagery to assist with cancer treatment, except in that case, imagery included visualizing white cells attacking cancer cells rather than sending qi to the area.

Visualization imagery is used to help learn the breathing techniques and the movements of qi gong and taiji chuan. Since the language of qigong and taiji chuan comes from a linguistically visually based culture (China), the practices inherently utilize imagery and visualization and incorporate mindfulness by default. Taiji chuan is a martial art that incorporates qi gong along with fighting. An opponent's qi flow is used to move the individual around, much as the Japanese equivalent of ki is used to direct opponents in aikido. Hansell (2008), who has also studied with the Yang family, studies taiji chuan and qi gong with taiji master Dr. Cheng Xian Hao, who learned from Taoist monks at the Shaolin monastery in China. In teaching both healing and martial practices, Dr. Cheng uses imagery. Attention, awareness, and mindfulness are integral to the practice of qi gong and taiji chuan and the initial focus is on the breath. It is often difficult for people to focus on the breathing, so students are encouraged to give their breath a color both on the inhale and the exhale, for example, red on the way in and blue on the way out. Endurance athletes use similar techniques to focus and maintain energy – breathe in energy, exhale exhaustion. When teaching taiji chuan, it is helpful to know the martial intention of each of the movements and students are encouraged to visualize an opponent of equal size when practicing. For example, in the "white crane spreads wings" movement in Yang style taiji chuan, you are grasping an opponent's arms and separating them, locking the opponent's joints as you do so. At the same time your right foot is free to kick. Visual stories are coupled with some movements as well. One long movement is called "grasp the bird's tail." It consists of the components ward off, roll back, press, and push. In ward off, you extend your arms to give a beautiful bird you see a place to land. In roll back you separate the wings to enjoy the beauty of the feathers. The bird is so beautiful that you decide to free it, which is the press component. You have second thoughts as the bird flies away and you reach forward with the push component trying to recapture the bird. When ward off is taught by itself, the student is encouraged to visualize the self as the ocean and the opponent as a boat. The student does not push or resist, but is instead using the soft and flexible to overcome the hard and the rigid. Throughout movements you maintain a kinesthetic awareness to maintain balance and agility. Balance is increased as well as the ability to be mindful and meditate. "Holding the ball" is a visualization used throughout taiji chuan. Picturing yourself holding a ball helps you learn the hand movements for transitions between movements, learn the martial intentions of the movement, and also lines up the acupuncture and lao gong points of the hands to maximize the qi flow in the body for both power and health.

Sancier & Hole (2001) point out that it is difficult to find research on qigong. Most past research was done exclusively in China and printed in Chinese. A Computerized Qigong Database was created in 1986 and as of 2001 had about 1500 citations taken from meetings, journals, and Medline. However, many do not meet the Western scientific standards. Metzger & Zhou (1996) state that the Chinese do not have a need to intellectually describe what qi is or exactly how the practices of acupuncture or qigong work. It is enough that they have worked for over 2500 years. The focus is on "how" rather than "why". Watts might ask that if the brain is a mechanism like any other machine or even a sensory organ, how can it possibly be expected to understand its own workings? It cannot directly experience itself any more than an eye can directly gaze at its own retina.

Traditionally, qigong, like taiji chuan, was passed down in families as an art. The Cultural Revolution in the 1960s outlawed qigong and qigong masters were persecuted. When research began in the 1970s, for the most part, the masters were not available. Among the studies reviewed by Sancier & Hole (2001) was one by Mayer (1997) that involved pain relief. Qigong imagery along with Western psychotherapy and hypnotherapy was used to alleviate chronic pain. The individual was directed to focus his mind and to direct qi to flow continuously around his body to help remove blockages. Sancier & Hole (2001) theorize that the components of qigong – physical movement, focused meditation (including imagery), breathing, and self massage, give it an ability to relax the mind, tissues, muscles, and tendons that are injured, stressed, or diseased allowing for the increase of blood flow to the areas resulting in healing and increased immunity. The increased blood circulation may also enhance the removal of toxins and metabolic waste from diseased and injured areas resulting in pain reduction.

Sancier & Hole (2001) also cited the work of Higuchi (1997) who examined the hormonal effects of qigong meditation by measuring endocrine and immune responses in six qigong practitioners and seven non-practitioners before and after a thirty minute qigong meditation session for the practitioners. It is not stated what the non-practitioners did during that time. Compared to the non-practitioners, the practitioners had lower levels of plasma cortisol, adrenaline, dopamine, and beta-endorphin, which led the researcher to hypothesize that qigong, at least meditative qigong, decreases sympathetic nervous system activity.

The Electoracupuncture According to Vole (EAV) is an instrument used to measure electrical activity/conductivity at acupuncture points on the meridians. Sancier & Hole (2001) measured points on individuals before and after qigong sessions of fifteen minutes and found that seven of eleven were able to balance qi after qigong, that is, the readings were essentially the same at all the points. Qi in the body had been brought into balance.

Johansson, Hassmen, & Jouper (2008) examined qigong's effect on mood and anxiety. Qigong in this study consisted of slow deliberate movements, relaxed breathing, and deep mental focusing with the goal of inducing a relaxation response and a lowering of the sympathetic nervous system – reduced metabolism, heart rate, blood pressure and breathing rate. There were sixty one participants in the study all of whom were either qigong practitioners or instructors. They were divided into two groups, one of which would practice a standardized qigong form for thirty minutes a day. The form was given as a recording so that each individual got the same instruction every day. The control group listened to recorded lectures on qigong for thirty minutes each day. Prior to beginning training all were tested using the Profile of Mood States (POMS) and the State and Trait Anxiety Inventory. The POMS measures six mood states – tension/anxiety, depression/dejection, anger/hostility, vigor/activity, fatigue/inertia, and confusion/bewilderment with the question eliciting the mood rating being, “how are you feeling right now?” Part of the qigong included body focus – focusing on the joints and inducing relaxation in the whole body. Mindfulness was also stressed during the movements. The mean age of all the participants was about fifty, and all had been practicing qigong for an average almost five years. The study took place at a summer health institute and the recorded lecture was given by the founder and qigong master of the summer institute where the study took place. State anxiety, depression, anger and fatigue scores were significantly reduced for the qigong group as compared to the controls. Tension, vigor, and confusion means were also reduced but not significantly. The authors speculate that this may have been partly due to the cognitive nature of the lecture, at least in the case of confusion, and this is especially true given that the lecture was given by a very important figure in this particular qigong community. Other confounds were that all the participants were experienced in qigong. It would be interesting to compare groups with no experience or expectations to measure effect. There may have also been a reporting bias in that those in the control group went to the camp with the expectation of actually practicing qigong but instead listened to lectures. Despite all that, the significant results do support qigong for stress/anxiety reduction.

Chen (2007) also found evidence for stress management using qigong in a review of case studies. He stressed that qigong incorporates both physical and psychological principles in healing. Schure, Christopher, & Christopher (2008) found further evidence for the use of qigong in stress relief and management in a qualitative four of graduate counseling program students. The study used a combination of qigong, hatha yoga and meditation to teach stress reduction to the students in a fifteen week course. Stress reduction occurred and the students indicated that they would continue to practice and also that they would incorporate it into their profession upon graduation. Hui, Wan, Chan, & Yung (2006) examined the use of qigong and progressive relaxation techniques on the quality of life of cardiac patients in a hospital in Hong Kong. Both psychological components (utilizing the Quality of Life Short Form 36, the State-Trait Anxiety

Inventory) and physical components (using the General Health Questionnaire and measures such as blood pressure) were tracked in comparison to a control group over the course of eight rehabilitation sessions. The treated group of participants had lowered blood pressure and increased improvement in psychological measures.

Qigong and taiji chuan are often touted as ways to maintain fitness and slow down aging. Kemps & Newson (2005) examined the effects of aging on mental imagery. They compared three cohorts of individuals who were "young" (18-29 years old), "young old" (65-74 years old) and "old old" (75-86 years old). Imagery tasks were done on an IBM computer (which in itself may have been a confounding factor experientially when comparing 18 year olds to 80 year olds) and were given imagery generation, imagery maintenance, imagery scanning, and imagery rotation tasks. They were tested on processing speed, working memory, executive functioning and sensorimotor functioning. Older participants took about three times as long to complete tasks as younger participants, made substantially more errors on image maintenance, and required more time to generate and especially to rotate imagery. Results indicated that "older adults are not as proficient as the younger adults in activating and adding successive segments to mental images" (p. 123). Older and younger adults were comparable however on self reported vividness of images and on perceived image control. Where older adults fell behind was in processing speed, working memory, executive function and sensorimotor functioning. Some decline could be due to deterioration in vision and hearing in older adults which could affect imagery ability as well. Perhaps declining function of the sense organs exercises the corresponding areas of the brain less, and since these areas are also associated with imagery, imagery ability could decline. The authors conclude that the differences were due to "how quickly information can be processed and on the neurophysiological integrity of the brain" (p. 99).

One study was found that looked at taiji chuan's effect on the plasticity of the brain. Kerr, Shaw, Wasserman, Chen, Kanojia, Bayer, and Kelley (2008) compared a group of experienced taiji chuan practitioners to a matched group of non-practitioners on a task of tactile acuity in the finger tips, a process which shows age related decline. Tactile acuity was defined as the ability to discriminate between horizontal and vertical orientations across different grating widths at the finger tips. The practitioners' ability to discriminate spatial acuity was significantly superior to the non-practitioners. The authors felt that taiji chuan's slow movements concentrating on form and body awareness or the body's extremities helps to slow age related decline in tactile acuity by an effect on cortical plasticity and called for follow up research for longitudinal cortical mapping studies of taiji chuan practitioners as well as yoga, qigong, and mindfulness meditation to see if these related practices might have similar effects.

Culture as a factor

Eastern and Western cultures have fundamentally different views of the "self." Csikszentmihalyi & Rochberg-Halton (1981) discuss the development of the concept of self as beginning with the infant who learns to connect action with satisfaction of needs and development of control. The person is an independent individual agent separate from all else. In both Taoism and Buddhism, the separate self is an illusion and everything in life is a relationship (Beck, 1989). Watts & Huang(1975) elaborate on the difficulty of differentiating one thing from another. There is virtually an infinite number of variables attached to any event. How does one decide which are relevant and which are not. An illustrative Zen story of the inter-connectedness of all things involves a simple slice of bread. Within that bread is the person who baked it, the ingredients and all those who grew the ingredients, those who made the hardware used for baking, those who minded the material to make the hardware, those who supplied the fuel for transport and for baking, those who transported the ingredients and the finished product, the sun, the water, and the soil required for growing the ingredients, the return to the soil of the bread with composting, and on and on in an unending process of intertwined relationships. The absence of concreteness of a thing can be expressed by a rose with its growth cycle. When it is cut, people consider it beautiful when it is at its peak, but consider it trash to be discarded when it whithers. The rose we experience at any given moment is a process in transition and not the concrete thing we think we experience. The very qualities we put upon it are our own constructs culturally bound. The rose itself is just a rose – not a symbol in and of itself. We put the symbolism upon it. In China, a rose may be written with an ideogram of a flower. The West uses alphabetic words to represent it. Watts & Huang (1975) point out how words as abstract thought representations have the difficulty of being circular in definition. We use abstract words to define abstract words and ultimately definitions collapse back upon themselves. Merriam-Webster's Dictionary defines a potato as a fruit of the plant of the nightshade family. It defines nightshade as "any of a genus (*Solanum* of the family Solanaceae, the nightshade family) of herbs, shrubs, and trees having alternate leaves, cymose flowers, and fruits that are berries and including some poisonous weeds, various ornamentals, and important crop plants (as the potato and eggplant)." A potato is a nightshade plant is a potato and the words still do not give us the essence of a potato. To know the essence, you must taste and touch and smell and feel the potato, but even then, there are many varieties each with its own characteristics, and even potatoes of the same variety are different based on the growing conditions, how long since they were harvested, etc. Watts and Huang (1975) put it thusly:

> "Western science has stressed the attitude of objectivity – a cold, calculating, and detached attitude through which it appears that natural phenomena, including the human organism, are nothing but mechanisms. But, as the word itself implies, a universe of mere objects is objectional. We feel justified in exploiting it ruthlessly, but now we are belatedly realizing that the ill-treatment of the environment is damage to ourselves – for the simple reason that subject and object cannot be separated, and that we and our surroundings are the process of a unified field, which is what the Chinese call Tao." (p. 16)

Kerr (2002) discussed the problems with Western research methods which attempt to find therapies not dependent on time or place. She asks, "How should investigators seeking therapies not dependent on time or place come to understand traditional healing practices, which exist in (and may, to some extent, derive their efficacy from) the rich and irreducible contexts which shape patient experience?" (p. 421). Issues include the lack of the cultural and historical context of qigong in the United States when the practice is researched. There is also the issue that practitioners in the United States for the most part come from the taiji chuan martial arts community of teachers. In China, there are medical practices and hospitals with qigong as a central part of the practice. American response to therapy is most likely altered by both a lack of knowledge and context and by expectations based on whatever beliefs they might have concerning the practice. Kerr's (2002) particular study took place at the Dana-Farber Cancer Institute in Boston. The study compared the effects of qigong to low impact aerobic exercise on the immune systems, quality of life, and physical functioning of groups of former cancer patients. She looked at the differences in the conceptualization of the study between the bio-medical team and the qigong master involved in the research. She cites Benson's (1997) attempt at explaining the relaxation response associated with imagery as a top down response in the neural system. She found that he took the reports of the participants, who stated that the visualization in the meditation processes felt like physical and mental were intertwined, and disregarded it choosing instead to interpret the experience within his model of universal emotional top down response. The context and experience which did not fit were ignored. In the case of this study, the bio-medical team viewed the work as a dualistic mind-body study while the qigong master viewed it as a mind-in-body (one entity) approach. Based on this dichotomy, she suggests that "investigators should build processes of dialogue and translation into their inquiry rather than simply using studies of context as a means for pushing quickly to "full-scale randomized clinical trials on the application of traditional, indigenous systems" (p. 443).

Beliefs and expectations as factors in performance enhancement, healing, and change

Overall research shows that imagery has a positive impact on enhancing athletic performance and on healing in general. The exact nature of how it works at a neuron-cellular level is not clear, but what is clear is that it changes perception and changes the brain and nervous system from both top down and bottom up. What we image can change what we perceive and what we perceive can change what we image and we are changed at a cellular level when either occurs.

Rossman (2000) relates a story from his second year of medical practice in which a middle aged woman came to him with a two year old diagnosis of pre-cancerous uterine cervix cells. She had turned down surgery four times, and presented to him for help with keeping her blood pressure down. Her medical record mentioned issues with irrational beliefs about healing and possible psychopathology. When asked why she refused to follow the other physicians' recommendations, whose notes reflected an increasing sense of frustration with her, she said that she felt that Jesus would heal her and had told her so. Rossman asked her how she talked with Jesus and she said that she talked with him in the same way she was speaking with Rossman, plus in prayer. Rossman then asked her if she would be able to speak with Jesus at that moment and to see if he would heal her in six weeks time. She agreed, closed her eyes and some minutes later said that the conversation had taken place and the Jesus had agreed. She returned in six weeks for examination. Her cervix appeared normal on visual examination and her Pap smear returned with no abnormalities. Rossman uses this as an example of the powerful healing effects of faith, belief, and placebo.

Using a literature review, Miller, Hubble, Duncan (2007) examined the concept of the "supershrink", therapists who are effective in helping individuals effect change in their lives. Therapeutic change depended much more on the relationship of the therapist and client than whatever technique or type of therapy that the counselor utilized. The demographics of the individuals nor the experience or theoretical approach of the counselor did not cause differences in outcomes, and this held true even when drug therapy was involved. When pharmaceuticals were used, the outcomes were ten times better with the best therapists than with the worst, and with the worst therapists, the drugs had no effect on outcomes at all. People receiving counseling from the best therapists rated themselves as getting better by 50% as opposed to those with the worst therapists, and those with the worst therapists were 50% more likely to drop out of counseling. What was found to differentiate the best therapists from the worst was that the best worked harder at improving the work, and they were attentive to feedback from the clients they saw. Despite the differences in outcomes, the therapists with the worst outcomes rated themselves equally effective with those with the best outcomes. They had become more proficient and confident over time despite little to no improvement in outcomes. The authors also felt that most models of counseling account more for why people stay the same rather than how they change. People are diagnosed, and the diagnosis becomes a prognosis as it, rather than the relationship, drives the therapeutic process. Cohen & Bai (2008) echo a similar refrain finding that, in Buddhist and Taoist terms, a diagnosis serves to objectify the person being served in therapy. What they feel is most important is that the counselor be there with the client in the person's pain. What they feel the person needs is ontological security and that only comes when they establish a connection to themselves and with others that transcends the separation from self and others inherent in pain. Faggianelli and Lukoff (2006) found similar characteristics with skilled aikido practitioners who were also psychotherapists. Aikido is a Japanese martial art with similar beliefs as taiji chuan, except that qi is referred to as ki. There is no dualism of mind and body, the practice is one of being with the person in acceptance, and resistance was seen as only occurring if the therapist was trying to take the client somewhere they did not want to go. What a counselor might term as "resistance" was actually a vehicle for growth and understanding.

Tallman & Bohart (1999) expound upon the idea that the primary change agent in therapy is the client, not the therapist. They believe that the reason that change can occur in therapy regardless of the type of therapy is the inherent ability of clients to use whatever is offered. They offer exercise outcomes as an example. Many different methods are available, but it is the active effort and the follow through of the client that makes the difference. The approach of the coach can make a difference in whether an individual believes in and sticks with a particular plan, however. Again, it is the relationship of mutual respect and the two way openness to feedback that is important. They see placebos as causing physiological changes and bodily sensations which activate the process of the client's self healing. They specifically mention relaxation methods as having an active physical effect – changes in muscle tension and tone occur as well as states of awareness – but that these may not be directly involved in change and healing. "Instead, the more active and specific the procedure, the more believable it becomes to clients, thus mobilizing their intrinsic hope, energy, creativity, and self-healing potential. Personal agency is awakened by technique" (pp. 100-101). It is that awakening which effects change. The client must be involved with the process and the alliance is critical. Both the therapist and the client need to believe and have faith in the sought outcome. Client optimism, expectancy, and hope play crucial roles in outcomes for therapy (Scovern, 1999).

Chapter 3

Summary and Conclusions

When we discuss using imagery to improve performance and to heal, we are discussing many areas and many possibilities for research. We want to know how imagery works, and how an internal experience which emanates from within the mind can have such an impact. How is this processed in the brain and the body as a whole? At this point, we are not totally clear on the mechanics of perception and interpretation of sensory data we receive into ourselves, let alone that which we generate ourselves with or without guidance. Other factors play crucial roles in the use of imagery – our emotions, the meaning we give to images, our beliefs, etc. At the root of all this is how imagery helps us learn and change.

Ironically in the West, the study of imagery takes place with words – which are de facto imperfect representations of what is imaged regardless of the form or the mode of imagery. The debate between those who advocate that the brain actually visualizes in pictures that create action and those who advocate that it is reasoning that creates the action will go on. Since we use words to debate, the differences may be irreconcilable as linguistic and definitional hair splitting goes on. Allowing for the vast difference in imaging skills, both sides may be correct. Some individuals may think in purely pictures while others use words and many use varying combinations of both. There may be underlying differentiations in neural structures shaped by genetics, culture and experience both internal and external. The metaphor of flying by sight or by instruments demonstrates that at least with external perception, we are capable of doing both, albeit some perform better than others. Why cannot the same skills and individual differences occur internally in imagery? Pylyshyn and Kosslyn can stop disagreeing and work together. Both are at least partly, or perhaps fully, right. We are left with imperfect words to describe experience. There have been arguments as to whether light is particle or wave at least since the time of Pythagorus 2,500 years ago, and now physics says that light has properties of both and can act like both (Ball, 2006). Our mental representations of light (and sound and the other senses) may well be sensed and produced within ourselves in multiple ways. The pictorial theorists and the reasoning theorists of the West could work together with the non-dualistic and image rich story telling traditions to see what works for the individual – some pictures, some reasoning, many somewhere in between with qualities of both. With training, perhaps a person with a deficiency in one of the skills could be taught that skill, akin to being able to see the alternative picture in a Gestalt image. This could be especially helpful since current techniques for healing seem to require being able to visualize pictures of healing cells battling diseased cells. A person relying on reasoning would be at a loss. Murphy (2005) says that “visualization is the most important of the mental skills required for winning the mind game in sports” (p. 127) since so much of sport is visual.

One constant throughout studies was the assertion that the more skilled one is at imagery (higher vividness and control), the more the benefit, and studies used paper and pencil tests to determine the level of imaging ability. Moran (1993) examined many of the imagery rating questionnaires used in sports psychology and found them wanting in terms of validity. Just an agreed upon definition of what constitutes imagery is a problem, and indications are that imagery at the neuronal level is not one single trait but a set of diverse skills. Likewise, Short & Ross-Stewart (2006) find that there is still conceptual confusion over the terms imagery type, function, and outcome causing inconsistent findings among imagery studies and state that “the line between image, content, type, and function has blurred" (p. 4). They also recommend evaluating the instruments, focusing on the Sport Imagery Questionnaire.

In the East, where conceptualization is more visual and it is commonly accepted that ultimately words do not capture actions or what we perceive as the realities of life, the debate may occur, but is not defining. Healing and performance enhancement occur using different metaphors than those in the West. Qi is a concept thousands of years old and has worked pragmatically for healing and performance enhancement through practices such as qigong and taiji chuan.

Regardless of how imagery works, what is clear is that it does work. What brings the concepts of both West and East together is belief on the part of the individuals who facilitate imagery and those who use their imaginations to get better, whatever the method.

It is difficult in both imagery research in the West and in imagery research with Eastern practices such as qigong and taiji chuan to differentiate imagery from other practices that go hand in hand with these, whether it be movement, breathing, meditation, modeling, etc. It is difficult to isolate one function from others. With imagery being an introspective function, it is difficult to know whether an individual used imagery during a study or not, and if so, what kind.

One could argue that in addition to the standard forms of imagery – visual, kinesthetic, etc. – perhaps emotional awareness might be added. Emotion and imagery go together and could be components or subsystems of the same system at least to a degree. Imagery can evoke emotions quickly and can alter the brain and body chemistry quickly resulting in emotional change. Imagery is used in sport to regulate arousal and emotion and is used in healing to reduce stress.

Zull (2004) cited the 2004 work of Draganski et al which showed the effect of learning on the brain. Individuals were taught to juggle and continued to practice until they could keep three balls in the air continuously. The participants brains were scanned with MRI before and after learning. The visual area of the brain, particularly the part associated with movement became more dense as the number of neurons and their connections increased. When the participants stopped the practice of juggling, the density began to decrease as their skill level decreased. Since the same area of the brain would be involved in imagining juggling, perhaps that density could be maintained with imagery. An illustrative visual metaphor for learning could be the trails that settlers used to travel to the western part of what is now the United States in the 1800s. Vast numbers of people, wagons, horses, and oxen made the journey and the wheels and feet wore deep ruts in the land. The wind and rain of weather further eroded the trails into deep pathways by the twentieth century. If you want to travel to the same place as the original travelers, you have no problem, just follow the rut. If you want to travel somewhere different, you have to climb over the side and begin a new trail. The more you practice at it (walk the trail) and the more individuals you have practicing (walking with you), the more defined the new trail becomes. For plasticity and associational networking, think of settlements along the way. Some expand in to cities as more people settle there (the association is utilized or stimulated more). Some stay at stasis with an unchanging population over time, stimulated just enough to remain alive, like a behavior used just enough to keep it in memory. Say the silver runs out at a town and it becomes a ghost town. The structure of the town is still there, just as the neuronal structure for the memory or image may still be there, but it needs stimulation to come alive again. For example, gold is discovered and the skill/memory/image arises again on the structure, but is changed. Lastly perhaps a tornado takes out a town. This is similar to trauma that takes out a skill/memory/image. With help, the area may return, but it will be different from before and the original will never be the same. What was once in effect hardwired and static is now becoming part of a new network and becoming dynamic as it is actively changing.

Zull (2004) also stresses the active part of emotion in change and that emotion and thought are physically entangled in the brain, that our body feels the emotions (the effects of the sympathetic nervous system) and the emotional feelings affect how we think. It is a feedback loop. He says that learning should feel good since that increases motivation, and also that learning needs to be something that is of interest and in the perceptual language of the learner. He reports that explanations negate emotion and the negating of emotions negates learning and brain change. What he finds that works best for brain change and learning are stories, demonstrations, and metaphors. These imaging entities work to engage the whole brain – the sensory cortex which acquires information, the integrative cortex which makes meaning of the information, the integrative cortex which develops new ideas from the meaning, and the motor cortex, which acts on those ideas.

This goes well with Hubble, Duncan, & Miller’s (2007) review of what makes some therapists more effective than others. In reviewing Ericsson’s work on what made any one exceptional in their field, whether music, athletics, or any other field, it was not a question of being naturally or genetically gifted but the work and dedication of the individual. For example the top violinists spent more than twice as much time working on performance goals as the next best players and ten times as much as the average violinist. In effect, they were molding and changing their brains to increase performance. Imagery, whether Eastern or Western, can use the stories and metaphors and imaging methods which the individual seeking help can and does believe in to change the brain. In changing the brain with imagery, athletic performance can be enhanced, and healing can occur.

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