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The acute Effect of "White Ball" Qigong in Perceptual auditory Attention

- a prospective, randomized, placebo-controlled and single-blinded study -

Lara de Jesus Teixeira Lopes

Mestrado em Medicina Tradicional Chinesa

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Dissertação de Candidatura ao grau de Mestre em Medicina Tradicional Chinesa submetida ao Instituto de Ciências Biomédicas de Abel Salazar da Universidade do Porto.

Orientador - Henry Johannes Greten
Categoria - Professor Associado Convidado
Afiliação - Instituto de Ciências Biomédicas Abel Salazar da Universidade do Porto.

Co-orientador – Maria João Santos
Categoria – Mestre de Medicina Tradicional Chinesa
Afiliação – Heidelberg School of Traditional Chinese Medicine

Resumo

Enquadramento: A correlação entre técnicas de treino corpo-mente e a melhoria da performance cognitiva dos seus praticantes é um tópico de corrente interesse público. Os seus benefícios na Atenção, gestão de tarefas múltiplas simultâneas, mecanismos de autogestão do *stress* e melhorias no estado geral de saúde estão documentados. Qigong é uma técnica terapêutica da MTC com enorme sucesso clínico na gestão emocional e cognitiva. [6] [8-9] [13-14] [16] [18-20] [26-30] [35-45] Um dos problemas nas pesquisas sobre Qigong é a falta de controlos adequados. Nós desenvolvemos, recentemente, um Qigong Placebo e adoptamos essa metodologia no presente estudo. Pretendemos investigar se a prática única do Movimento "Bola Branca" do Qigong, durante 5 minutos, melhora a Atenção Auditiva Perceptual ou se é necessário uma prática regular mínima para obter os potenciais efeitos.

Objetivos:

1. Analisar o efeito agudo de 5 minutos de treino de Qigong sobre a Atenção Auditiva Perceptual, medida por tempo de reacção.
2. Comparar os tempos de reacção na condição acima descrita mas adicionando-lhes uma tarefa de distracção visual para testar a performance em cenários de Atenção Dividida.
3. Relacionar os objectivos 2 e 3 com os pressupostos das Teorias Clássicas da Psicologia da Atenção, tais como: Atenção Focada e Dividida, Processamento Paralelo e Modalidade-Cruzada, e assim, contribuir para uma melhor compreensão dos mecanismos subjacentes.

Hipóteses:

- H1 – Cinco minutos de Qigong com o Movimento "Bola Branca" afecta positivamente o TR, na condição experimental 1, indicando um efeito de melhoria sobre a atenção auditiva focada.
- H2 - Cinco minutos de Qigong com o Movimento "Bola Branca" afecta positivamente o TR, na condição experimental 2, indicando um efeito de melhoria sobre a atenção auditiva dividida de tipo dificuldade causada por cruzamento de modalidades sensoriais.

Métodos: Estudo Prospectivo, Randomizado com Controlo Placebo e cego.

Grupo de Controlo

Critério de Inclusão – 30 estudantes de Medicina naïves para a prática e pressupostos teóricos do Qigong. Foram randomizados em 2 grupos; Qigong Experimental Amador e Qigong Placebo Amador. Todos os sujeitos foram sujeitos a metodologia de estudo cego no que concerne à técnica de Qigong e seus pressupostos.

Grupo Experimental

Critério de Inclusão – Estudantes ou Profissionais de Medicina Tradicional Chinesa, tendo pelo menos 3 meses de prática regular de Qigong.

Um total de 25 pessoas, que pela sua formação académica e profissional, tiveram anteriormente treino de Qigong e, por isso, conheciam a sua teoria e conceitos associados foram submetidos à experiência e a estes chamamos o grupo experimental profissional.

Os tempos de reacção dos sujeitos para as condições acima descritas foram gravados num equipamento de Laboratório Biopac – antes do treino de 5 minutos de Qigong – e depois do mesmo.

Resultados:

Grupo de Controlo (Qigong Experimental Amador e Placebo);

Os tempos de resposta após a prática de Qigong, foram totalmente incongruentes; umas vezes aumentando outras diminuindo, sem qualquer efeito consistente.

Grupo Experimental (Qigong verdadeiro com efeito de condicionamento);

Não foi feita randomização devido ao tamanho do grupo.

Ao contrário do que aconteceu nos grupos de controlo (placebo e experimental amador), o grupo experimental profissional foi bastante consistente, tendo os tempos de reacção sido mais rápidos nas duas condições experimentais.

Foi obtido um nível de significância estatística muito relevante nas duas hipóteses.

H1 = P Value 0.006

H2 = P Value 0.003 (com distracção visual)

Discussão:

Os efeitos do Qigong estão dependents de *Condicionamento*. Após algum tempo de prática regular, o Cérebro e o Sistema Somatossensorial aprendem um padrão que é facilmente reconhecido nos treinos futuros levando à activação imediata da sensação de *Qi.*

Grupo de Controlo: devido à ausência de prática anterior, verificou-se a falta de melhoria da performance esperada pelo efeito de *condicionamento.*

Grupo Experimental: verificou-se o efeito positivo de condicionamento devido à prática e conhecimentos teóricos mais profundos do Qigong.

Conclusão:

O Movimento de Qigong "Bola Branca", do modelo de Heidelberg®, tem um efeito positivo nos mecanismos de Atenção Auditiva - focada e dividida – verificado pelo aumento de rapidez de resposta dos sujeitos experimentais.

Estes resultados reforçam a importância do processo de educação sobre a técnica do Qigong juntamente com os seus movimentos, princípios e mecanismos de acção.

Palavras-Chave: Qigong – Auditory Attention – Chi Kung – Qi Therapy – Heidelberg Model of TCM

Abstract

Background:

The correlation between body-mind techniques, practice, and better cognitive performances is a current topic of public interest. Benefits in attention, multi-task management, stress-coping, well-being and general health improvements are documented. Qigong is a therapeutic technique from TCM with great clinical success on cognitive and emotional management. [6] [8-9] [13-14] [16] [18-20] [26-30] [35-45] One of the problems with Qigong research is the lack of adequate controls. We recently develop a placebo Qigong and adopted this methodology to the current research study. We were interested whether a single five minutes practice of the White Ball Qi Gong exercise improved the Perceptual Auditory Attention or if a minimum of training is necessary to obtain potential effects.

Objectives:

1. Analyze the acute effect of 5-Minute Qigong training on Focus Perceptual Auditory Attention as measured by reaction time.
2. Compare reaction times in the conditions described above but adding a visual distraction task, testing the performance for Divided Attention scenarios.
3. Relate parameters in objective 1 and 2 to Psychological Attention Theories assumptions, such as; Focused and Divided Attention mechanisms, Parallel Processing and Cross-Modality, contributing to a better understanding of the underlying mechanisms.

Hypotheses:

H1 - Five-minute "White-ball" Qigong movement shortens the RT, indicating an improvement effect over focused auditory attention, in experimental condition 1; individuals were to listen to a randomized interval sounds' sequence, with closed eyes.

H2 - Five-minute "White-ball" Qigong movement shortens the RT, indicating an improvement effect over auditory divided attention of cross-modal difficulty type design, in experimental condition 2; still with randomized cadency of sounds, but open eyes plus visual distraction (following some LED lights movements with their other hand).

Methods: It is a Prospective Randomized Placebo Control and single Blinded study.

Control Group

Inclusion Criteria - 30 Medical students' naïve to Qigong practices and theory. We randomly divided them into 2 groups – experimental amateur and placebo amateur. All of those individuals were *blinded* to the technique and assumptions.

Experimental Group

Inclusion Criteria – Students or practitioners of Traditional Chinese Medicine, having at least 3 months of Qigong regular practice.

A total of 25 people which, by their education, have had previous training of Qigong and knew its theory and concepts did the experiment. We called this group the professional experimental group.

Individual's reaction time to the experimental conditions listed above was recorded by a Biopac Laboratory software at a baseline - before the 5-minute Qigong practice - and after.

Results:

Control Group (Placebo and Experimental Amateur Qigong);

RT after the "Qigong" training was totally incongruent; sometimes shorter others longer, with no consistent effect.

Experimental Group (Real Qigong with conditioning effect);

No randomization was done due to the group size. Opposite to Control Group (both placebo and experimental amateur), the professional experimental group was very consistent, with their reaction times getting faster in both experimental conditions.

Statistically very significant P values were obtained on both hypotheses.

H1 = P Value 0.006

H2 = P Value 0.003 (with visual distraction)

Discussion:

Qigong effects are subject to *Conditioning*. After some regular training, the Brain and the somatosensory system learns a pattern that is easily recognized in future practice leading to an immediate activation of the Qi sensation.

Control Group: there was a lack of positive conditioning effect due to lack of training.

Experimental Group: a positive conditioning effect has occurred and we suggest that it is due to a deeper education and training in Qigong.

Conclusion:

The “White Ball” Qigong movement, from the Heidelberg® model, has a positive effect over the Auditory Attention mechanisms – focus and divided – verified by the increasing speed of the reaction time in the experimental group.

The results support the importance of a thorough education in the Qigong technique for obtaining the effects.

Keywords: Qigong – Auditory Attention – Chi Kung – Qi Therapy – Heidelberg Model of TCM

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Abbreviations

AT	Alexander Technique
C1	Experimental Condition 1
C2	Experimental Condition 2
C3	Experimental Condition 3
C4	Experimental Condition 4
CMQ	Chinese Medical Qigong
CP	Cognitive Psychology
CPP	Controlled Parallel Processing
EEG	Electroencephalograph
EQ	External Qi
EXP_AM	Experimental amateur group test – real qigong (5min)
EXP_PRO	Experimental professional group test – real qigong (5min)
H1	Hypothesis 1
H2	Hypothesis 2
H3	Hypothesis 3
H4	Hypothesis 4
HM	Heidelberg Model
MECPs	Movement-Based embodied contemplative practices
MTC	Medicina Tradicional Chinesa
Pc8	Pericarcardial 8 Acupoint (Pericardium 8)
PLAC	Placebo group test – visualization of a video (5min)
PTTCM	Psychotherapy in Traditional Chinese Medicine
R1	Renal 1 Acupoint (Kiddney 1)
RAND1_T0	Random sound stimuli
RAND1_T1	Random sound stimuli after test
RAND2_T0	Random sound stimuli + visual stimuli

RAND2_T1	Random sound stimuli + visual stimuli after test
Rg20	Regens 20 Acupoint (Du Mai 20)
RHYTH1_T0	Rhythmic sound stimuli
RHYTH1_T1	Rhythmic sound stimuli after test
RHYTH2_T0	Rhythmic sound stimuli + visual stimuli
RHYTH2_T1	Rhythmic sound stimuli + visual stimuli after test
RT	Reaction Time
S1	Segment 1
S2	Segment 2
S3	Segment 3
S4	Segment 4
TCM	Traditional Chinese Medicine
TR	Tempo de Resposta
WBQ	White Ball Qigong

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Introduction

"If neuroscience will remain open to encountering phenomena not previously recognized, this will undoubtedly improvement our scientific understanding of human functioning and of how ancient practices can enhance human wellbeing in our modern times."

Laura Schmalzl

Attention is important for many activities, perception, voluntary recall, and the development of skills. Even the coordination of execution of any or several of the activities described requires attention to minimize interference.

Thus, moving a positive effect over such a great mental system is, at least, very encouraging. As one might explore better in Results Chapter, Qigong of only five minutes long induces statistically very relevant performance improvements.

In the last twenty years, huge improvements on the scientific research about Qigong effects had been made. Results had shown great Health and Performance benefits of an almost costless technique, when practiced with some basic and relative knowledge.

As one might think, it is difficult to analyze, quantify and measure such an abstract concept – Qi (bioenergy) – however it is being done with irrefutable methods: EEG, brain scans, thermography, neurochemical analysis, neuro-electrophysiological measures, biopac reaction time, validated psychometric scales, amongst others.

As a general rule, experiments, as our own one, have a limitation related to sample sizes. However, these preliminary results, if confirmed, are so significant they could have a profound impact on science and society. It could have an enormous value for our health and for the cost of providing healthcare.

Our main research question was whether a single five minutes practice of the White Ball Qi Gong exercise improved the Perceptual Auditory Attention – both divided and focus mechanisms - or if a minimum of training is necessary to obtain potential effects.

State of Art – Literature Review

In order to review some core concepts for the present Thesis, Classic Books of TCM, PTTCM, Psychology, Cognitive Psychology, NeuroPsychology and Neurosciences were consulted.
Furthermore, the following databases were researched for scientific articles: Science Direct, B-on, Pubmed, EBC's Host, amongst others.

Our researching Keywords were: Qigong, Attention, Chi Kung, Qi Therapy, Auditory Attention and a combination of some of those like "Qigong and Attention".

Literature Review was grouped in the 2 first chapters of this Thesis: Chapter I for Attention Theories and Chapter II about Qigong and related Mind-in-Body training. The present study was done for the Master Program in Traditional Chinese Medicine according to the Heidelberg Model, an integrative and scientific approach. For that obvious reason, big theories of Attention and Qigong were reviewed covering the Traditional Chinese Medicine perspectives but also the Classical Cognitive Psychology and Psychotherapies approaches. Therefore, for these two central subjects, we covered both of these viewpoints, the PTTCM and the western mind study sciences.

1. Traditional Chinese Medicine - The Heidelberg Scientific Model

The Heidelberg Model of Traditional Chinese Medicine (TCM) is a scientific approach for the "controlled integration of Chinese medicine" Greten, 2009 that defends the existence of the following important preconditions while working with TCM in Western Health Systems:

1. A rational concept of TCM
2. Scientific proof of efficacy and safety
3. Quality control [46]

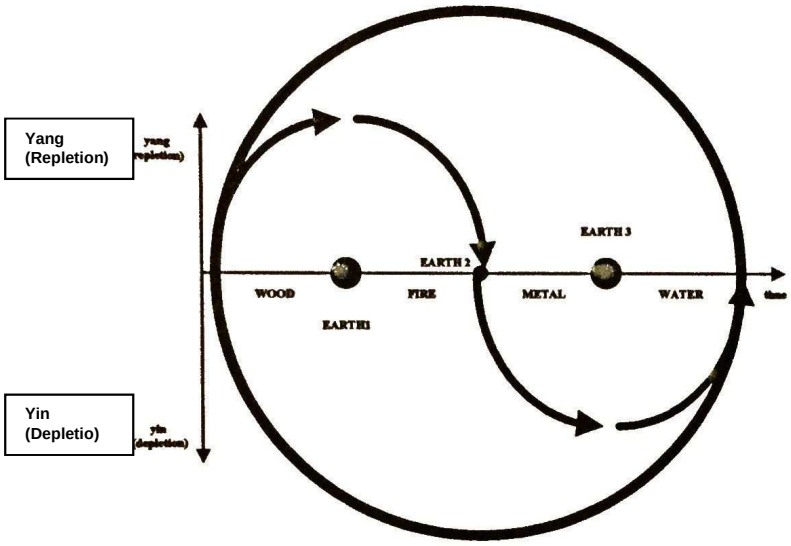
Regarding the "rational concept of **TCM**" it is defined as ***"a system of sensations and findings designed to establish a functional vegetative state"***.Greten, 2009

There are five well-known TCM main therapies that the TCM practitioner may use to treat that diagnosed "functional vegetative state":

1. Chinese pharmacotherapy
2. Acupuncture

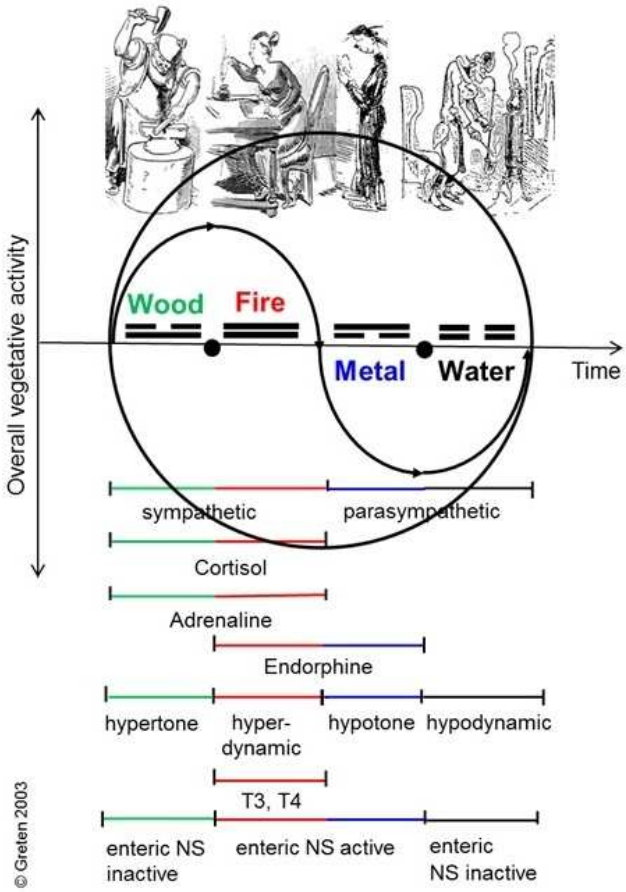
3. Chinese manual therapy (Tuina)
4. **Qigong**
5. Dietetics

According to TCM beliefs the ***"overall vegetative activity"*** of human beings could be first divided in two main groups depending on the level of function activation; **yin** or **depletion** for low activity or **yang** or **repletion** signs for high activity. And secondly, by **phases** or **"vegetative functional tendencies"** with their corresponding "groups of diagnostically relevant signs" named **"*Orbs"***.



Picture 1 - Yin/Yang Symbol representing the Overall Vegetative Activity (adapted from Greten, 2009)

In a Western medical interpretation the "overall vegetative activity" could be "expressed by the transmitter and vegetative systems involved." For instance, "in Yang phases sympathetic functions are more dominantly present" whereas in "Yin phases, the parasympathetic (vagal) activity is relatively more present".



Picture 2 - Western Physiological description of the Vegetative Sinus Wave *(adapted from Greten**, 2009**)*

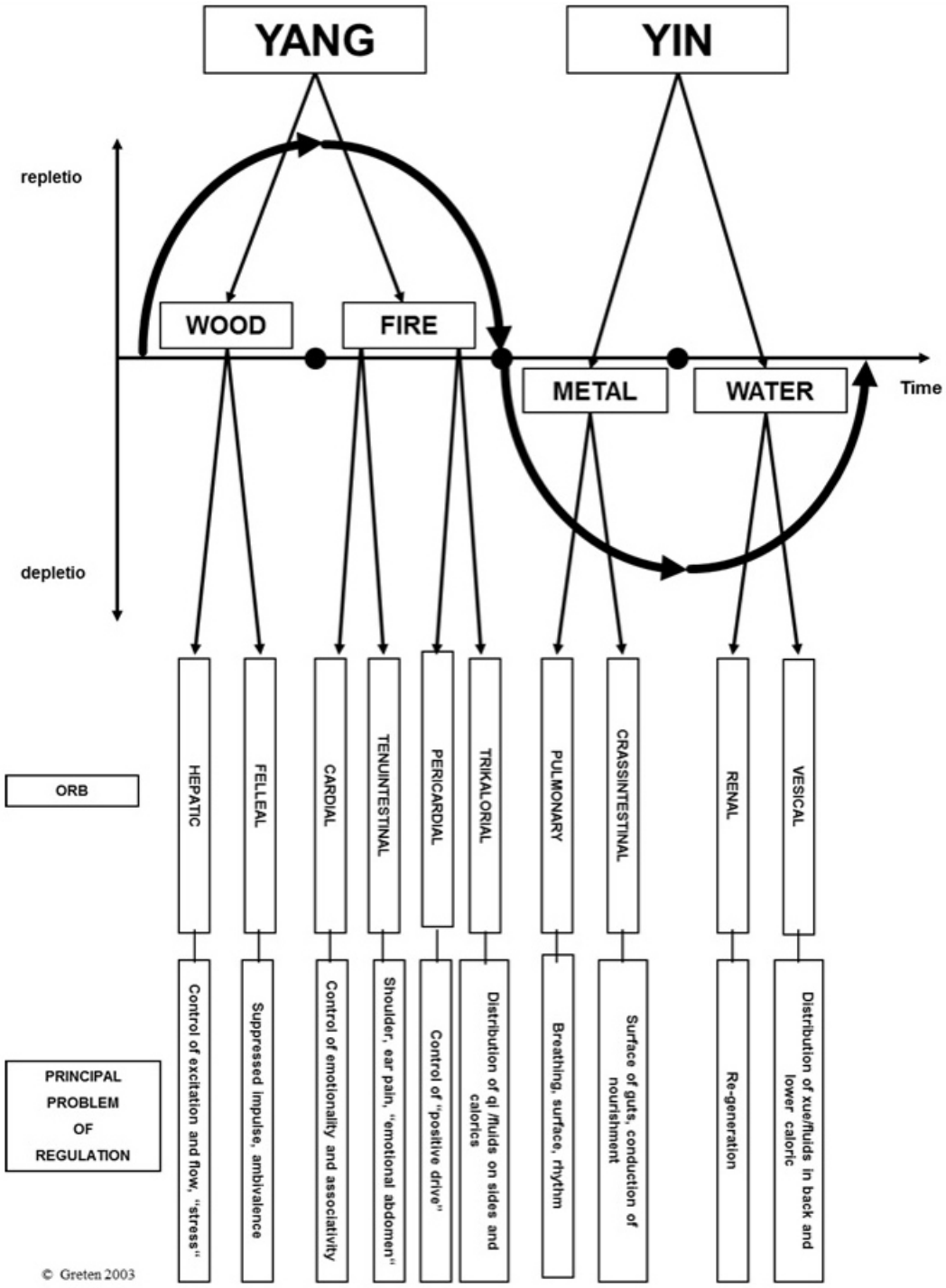
The System of the Orbs

An Orb is:

a) "Clinical manifestation of a phase, named after a region of the body (body island)

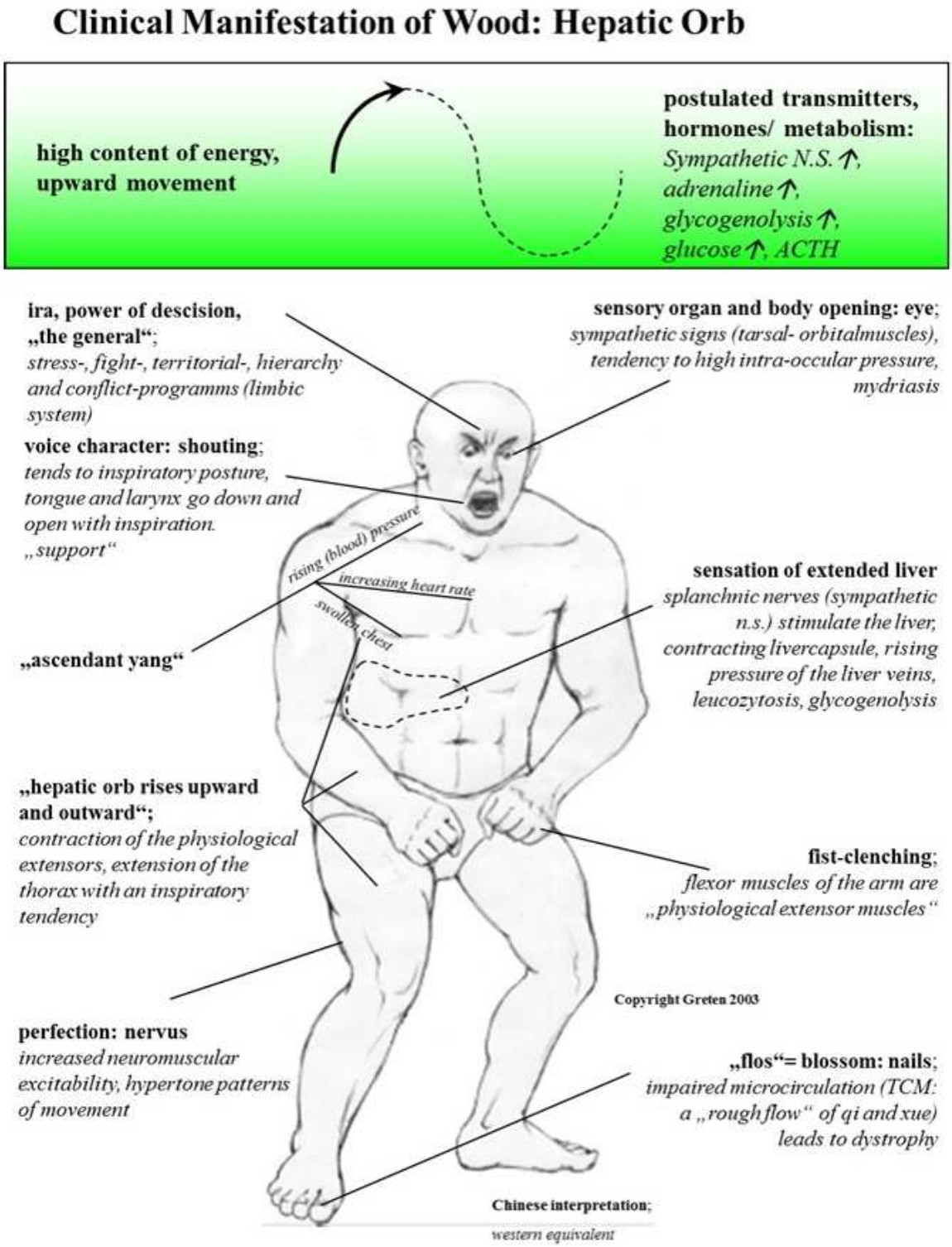
b) "A group of *diagnostically relevant signs* indicating the *functional state of a body island* (body region), which correlates with the *functional properties of a conduit."*

Following we present an arbogram with the critical symptoms of each *Orb.*

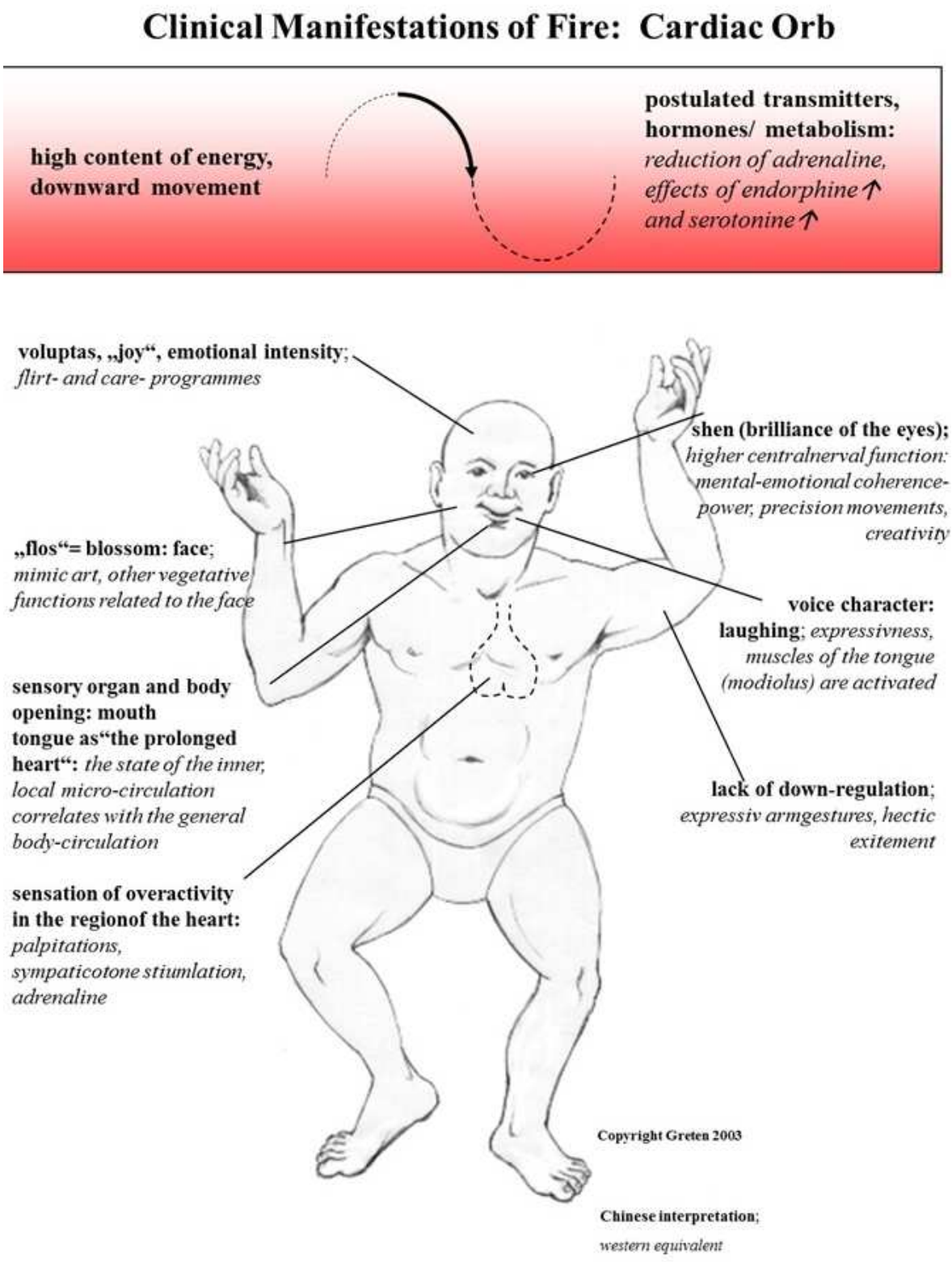


Picture 3 - The System of Orbs *(adapted from Greten, 2009)*

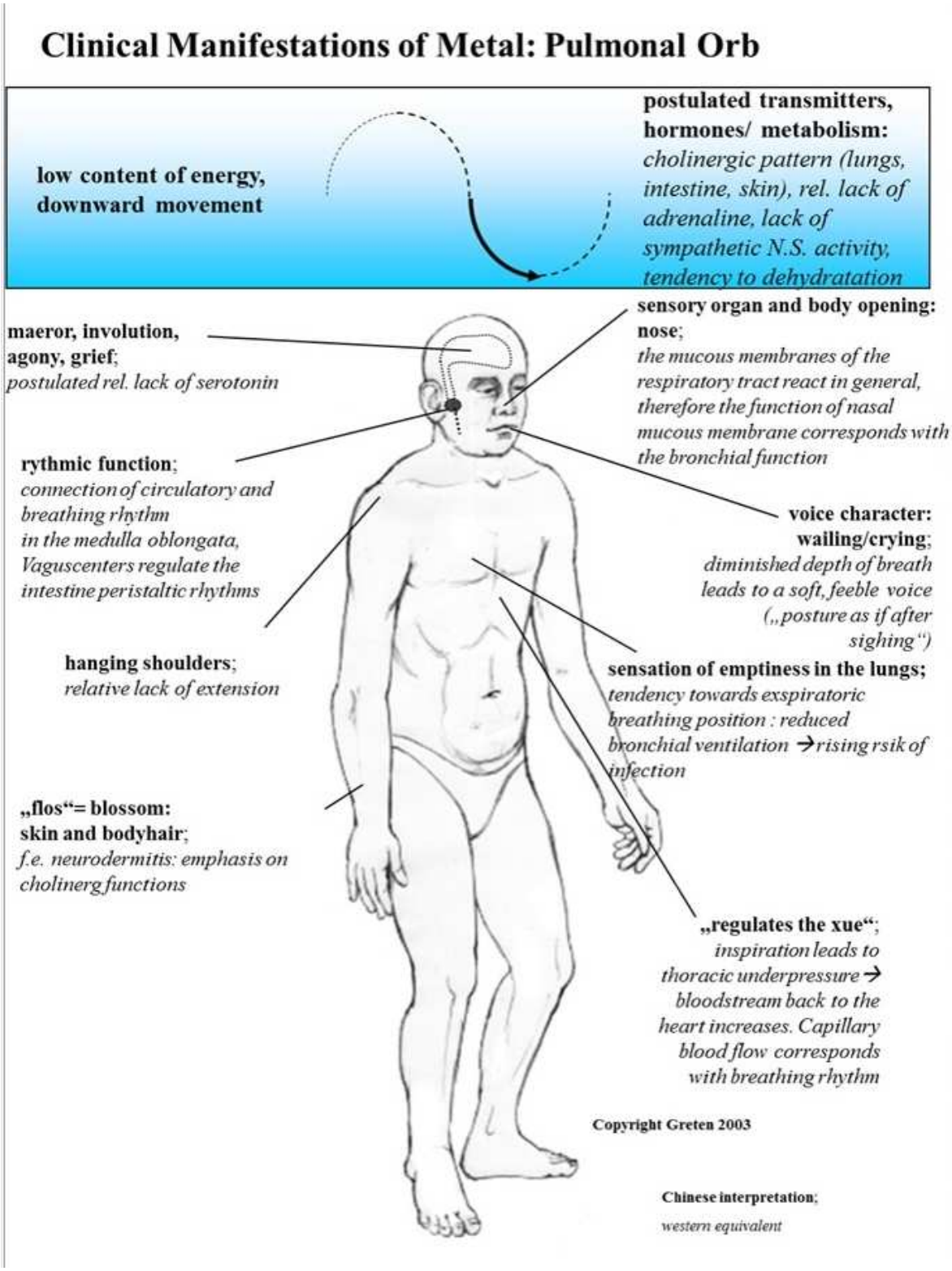
Phases, as we already mentioned are *<u>functional tendencies</u>* and are related to a group of signs and symptoms characterized by their corresponding *Orbs* - *<u>relevant signs</u>.*
To make it clear, we will present some pictures of common clinical manifestations of the Phases.



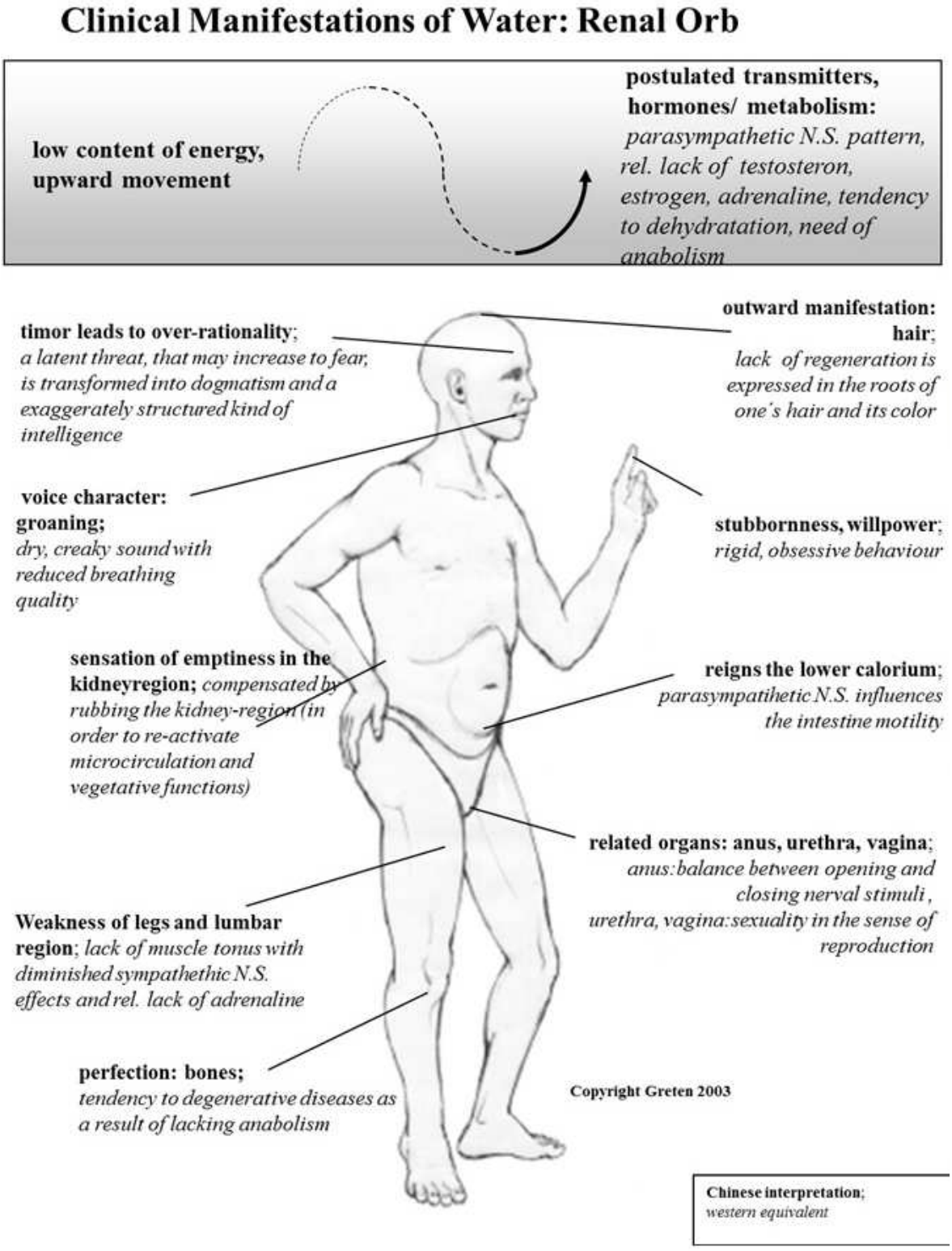
Picture 4 – Clinical Manifestation of WOOD Phase: hepatic orb *(adapted from Greten, 2009)*



Picture 5 - Clinical Manifestation of FIRE Phase: cardial orb ***(adapted from Greten, 2009)***



Picture 6 - Clinical Manifestation of METAL Phase: pulmonal orb (adapted from Greten, 2009)

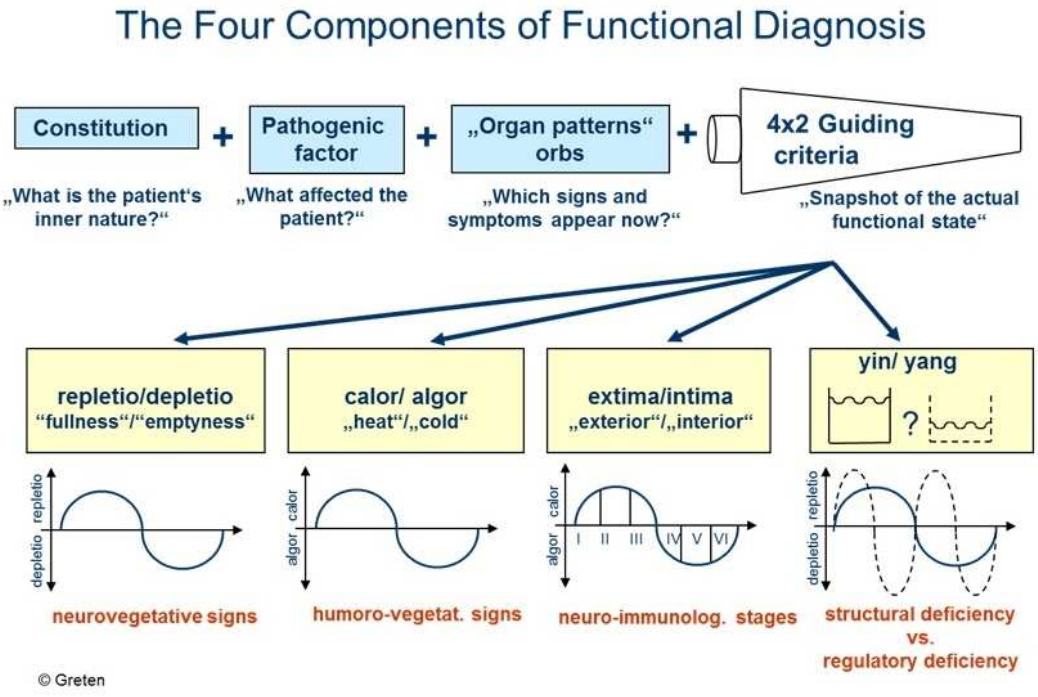


Picture 7 - Clinical Manifestation of WATER Phase: renal orb *(adapted from Greten, 2009)*

Summarizing, Phases main features are:

- Wood – creating potential
- Fire – transforming this potential into function
- Metal – lack of energy and rhythmic impulse
- Water – regeneration. (Greten, 2009)

Individual Diagnosis is the most valuable and powerful tool of TCM. Of course it is very complex and we will just present a resume image of the main components.



Picture 8 - Components of the Functional Diagnosis in TCM *(adapted from Greten, 2009)*

Qi Definition

Other classic definitions of Qi will be discussed on Chapter II, however we should present the interpretation of this central concept according to the Heildelberg Model:

"Vegetative capacity to function of a tissue or organ which may cause the sensation of pressure, tearing or flow". *(Greten, 2009)*

Looking at it as a concept from the Physics Sciences, "Qi" is a functional vegetative capacity to exert work, within the body it is related to the neurovegetative nervous system and to the microcirculation. *(Greten, 2010)*

That said, it is obvious that, nowadays, we have several tools that help us to analyze, quantify and measure this "Qi". From our experience and according the literature review, we may enumerate the following ones: EEG, Brains Scans, Thermography, Neurochemical analysis, Neuro-electrophysiological measures, Biopac reaction time and validated psychometric scales.

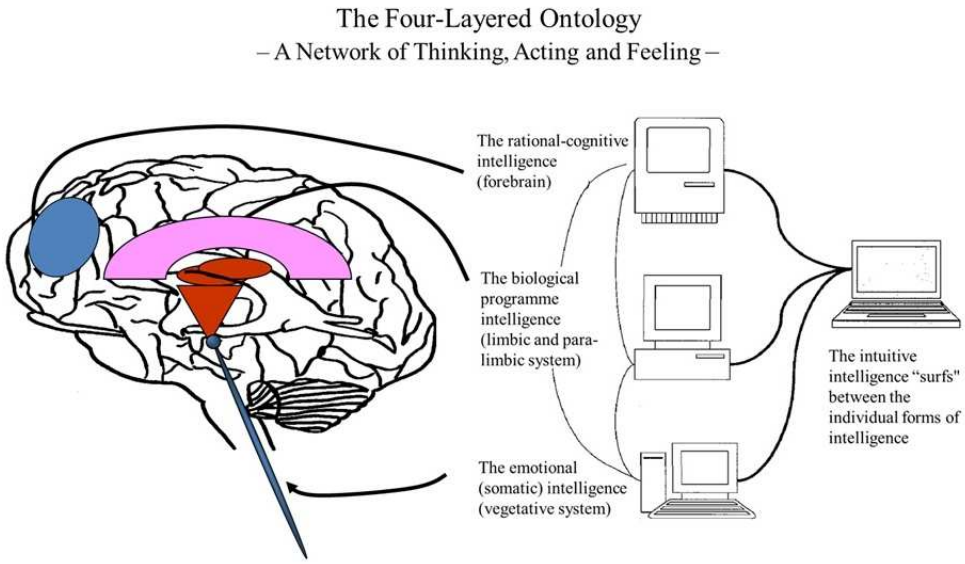
1.1. PTTCM - The Chinese Medicine Psychotherapy Approach

TCM is a Mind-IN-body medicine by excellence. No other give so much value to the effects of emotions on the orthopathy. The model of Phases is itself ruled by how the emotions change people homeostasis balance and induce pathogenic patterns.

In TCM, emotions are pathogenic agents, internal ones, and by that reason prone to cause severe affections. The Orbs are, also, characterized by emotional patterns. It is unimaginable for a TCM doctor to diagnose any disorder without thinking of emotions and mind function.

The four-layered ontology – a neurophysiologically model of thinking and acting

Greten 2011



Picture 9 - The Four-Layered Ontology *(adapted from Greten, 2011)*

This neurophysiological model is a Network of Thinking, Acting and Feeling explained by a computer metaphor.

Accordingly, four types of intelligence are related to four centers in the Brain:

1) Rational-cognitive intelligence – it is the "technical intelligence, uses words to express thinking and it is good for the solution of technical problems".

   Brain Location – frontal gyri of the forebrain

2) Biological programed intelligence – it is a "relational intelligence" as it is responsible for the organization of our relationships. It is our most ancient and archaic form of intelligence, exteriorized by our instinctive behaviors.

   Brain Location – limbic or paralimbic system

3) Emotional or somatic intelligence – "comes from our deepest feelings, it is the TCM "*vegetative intelligence"* that rules the balance and "digestion" of our emotions. Qigong practice activates pretty well this functional sensory modality.

   Brain Location – vegetative system

4) Intuitive intelligence – the "inner self-knowledge", knowns also as "your inner voice" that will "mediate between these other impulses of life and your inner plan". It is the "Dao" of Chinese Medicine.

   Mind Mechanism – it is like a central process mechanism that works for the integration of the other three intelligence forms, mediating and filtering how the other forms of intelligence relate with each other and it is responsible for the output behavior plan that some cultures define as "destiny". Metaphorically, it could be imagine as the signalman that defines the direction of the traffic.

With Qigong training, we were testing the effect of working in expanding intuitive intelligence over rational-cognitive intelligence.

That is a possible reason for experienced practitioners often refers the self-knowledge enhancement as the ultimate goal of their practice. [37]

During the movement practice, with the standing position and the white ball holding movement, individuals are strongly activating their somatic intelligence. And, of course, while following verbal communicated instructions or thinking about the sequence of the exercise, we are working with our rational-cognitive intelligence.

Thus, it is fairly understandable that Posadzki concluded, in his “The Psychology of Qigong” study that “practitioners are able to perceive these movements on various levels of energetic-psycho-physiological functioning”.

CHAPTER I

Attention

2. Attention in PTTCM terms

Attention mechanism, in TCM, is a ***Shen*** skill that it is the main function of the ***Cardial Orb***.

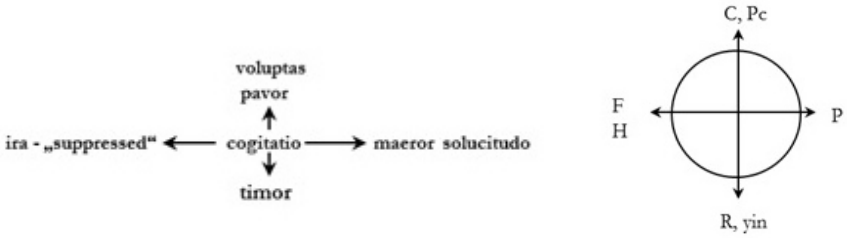
Shen, according to the HM is "the ***"functional capacity to put order into mental associativity and emotions, thus creating "mental presence".*** It is comparable to the capacity to exert certain higher brain functions, in western medicine."

Its functional state may be evaluated by signs such as:

- Speech coherence
- Fine motorics
- **Attention mechanisms**

TCM since its beginning looks to the treatment of diseases as "body-soul unit" interpretation, therefore psychotherapy and the treatment of emotional management is always included. Each *Orb,* as we already explained, has its related emotions and consequent behavioral characteristic. Even deeper, Chinese medicine, views central emotions (related to each phase) as crucial to determine people own "***constitutions****: tendency to express the signs of one orb predominantly so that they show in the physical phenotype."* *Greten, 2009*

Diagnosis in TCM, as suggested by HM, have a special detailed description of emotions as vectors functionally influencing those previous mentioned *Constitutional Types* (Personalities like, in Western terms). The following images synthetized that traditional assumption view of **emotions** either as **pathogenic agents** and **constitution (character/personality)**.



Picture 10 - Emotions as vectors of Phases and consequent Orb relation *[adapted by Greten, 2009)*

In western terms, we may interpret those assumptions as *neurological processes* stored by hypothalamus and the deeper layers of the limbic system with its vegetative centers associated.[48]

As Greten, pointed out “in human life, our intention, our ability to focus on something, our creative thinking, something that we call the **mind,** direct the capacity to act (Wood) in certain directions. Like this, there is a delicate interplay between the **cardiac orb** and the acting and vitalizing initiation of all doings by the **hepatic orb**”.

3. Cognitive Psychology - The Study of Mental Processes

In the mid-1950s Cognitive Psychology becomes dominant in research into psychology as it “allowed psychologists to study scientifically the hidden processes that operate between a stimulus and a response”.[1] What was lacking until then is now known under the umbrella term *cognition:* the act of knowing, perceiving or encoding something. Most of the times this “something” is of sensory input origin. Our experimental study made use of 3 important sensory stimulation forms:

1) Auditory – the sense that we have tested by measuring reaction times
2) Visual - as a distraction added to hinder the main task
3) Proprioceptive – during the Qigong training

Therefore it is not surprising that our laboratory data confirmed some classical theories and issues of Cognitive Psychology, as discussed later on Results and Discussion section.

When we read about Cognitive Psychology there is a transversal name in all the Students Handbooks, Broadbent. He developed the model of human information processing using the so called *“computer metaphor”.*

Although this model is most frequently described as a model of attention, it also includes perception and memory.[1] However it has aroused the curiosity of psychologists to deepen the research on each one of these subjects individually.

Broadbent´s distinguished between ***bottom-up*** and ***top-down*** processing information. “*Bottom-up* processing is said to be stimulus-driven because it is directly affected by the stimulus input. On the other hand, *top-down* processing is said to be conceptually driven as it is affected by existing knowledge derived from past experience.” [1] Our study design, as most of the experimental ones, is of *bottom-up* processing type. For understandable reasons, a quantitative and measurable experience cannot analyze the effect of the existing knowledge deriving from each individual past experiences.

3.1 Attention

"Attention is most commonly used to refer to selectivity of processing." [5]

William James, 1890

Attention is a *mechanism of information processing* characterized by diverse aspects, issues and variables of influence. Amongst others, it is consensual that:

- attention is a mechanism of *selectivity* of perception
- individuals have voluntary control over this selectivity
- and it has *capacity limitations*. [4]

The brain has the capacity to process the information in two ways: consciously or automatically. Those processes that require attention in some way are called controlled processes.[1]

Active Vs Passive Attention

One of the first thinkers who wrote about Attention was William James in the XIX century. He started by dividing it into Active and Passive Attention.

Active Attention is controlled by the individual's goals whereas Passive Attention is controlled by external stimulation. And it is for that reason that it is also known as *passive sensory attention.*

James also listed enumerated the **immediate effects of attention**:

a) perceiving
b) conceiving
c) distinguishing
d) remembering
e) shortening of "reaction-time"

A century later, Yantis in 1998, concluded from his experimental procedures about ***processing effort*** that "Stimulus-driven attentional control is both faster and more potent than goal-driven attentional control" because deciding which stimulus is most relevant to the current goal requires that extraordinary effort in terms of mental processing. [5]

Our study was designed to minimize *processing effort* activation in order to control subjective and individual characteristics bias. Although, according to Mr. William James it was an ***Active Attention*** study type, as stimuli attributes and tasks given to individuals required minimal processing effort activation. In addition, we choose to work with the shortening reaction-time effect as a reliable quantitative measurement method to validate our experimental hypotheses.

3.2 Theories of Attention

3.2.1 Divided Attention

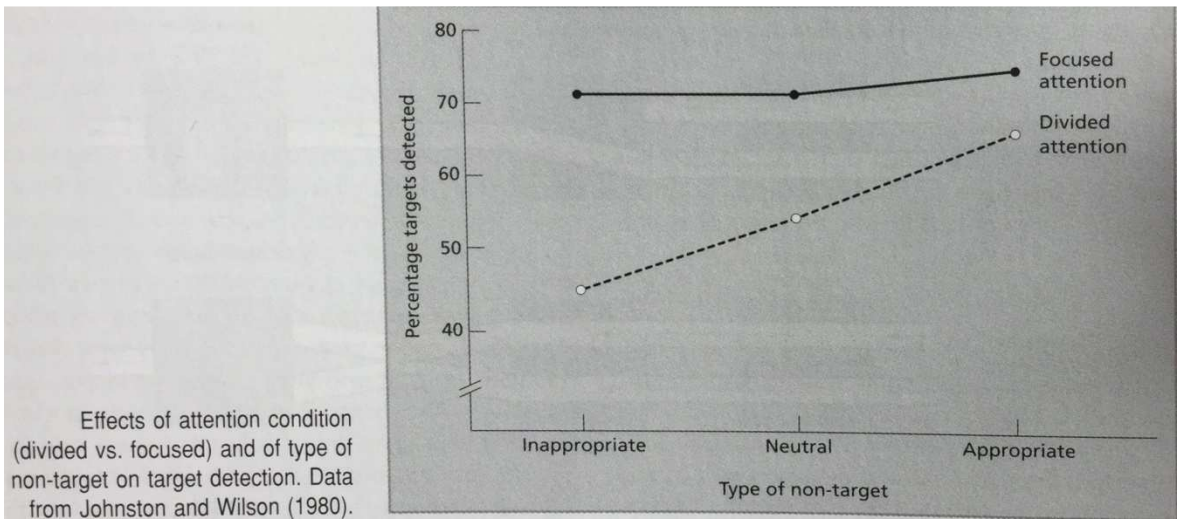
This topic research started with some introspective questions of great precursors of Psychology. “Whether it is possible to attend to several inputs at once” (James, 1890/1950, p. 405) or “How the speed of responses to a stimulus depends on whether a person chooses to attend to the stimulus or to the response” (Catwell, 1893/1947).

But Cognitive Psychologists keep searching answers for questions like “What happens when a person attempts to take in sensory information from several sources at approximately the same time.” (Pashler, H., 1998)

On the present study we found interesting results for the experimental conditions where we tested the influence of adding a visual distraction to the main auditory stimuli task suggesting a positive effect of Qigong practice over ***Bimodal Divided Attention*** mechanisms.

We had hypothesized that adding a visual task to the experimental procedure may augment reaction time to the auditory main task stimulation. For validation of this hypothesis see further on Discussion and Results.

Our idea was supported by scientific evidence of Intermodal selection effects in Bimodal Selective Attention such as Greenwald (1970) investigations where visual digits were being presented simultaneously with audio tapes (auditory stimuli). Subject's responses to the visually presented digits slowed down by about 35 msec when accompanied by another digit being spelled aurally by the tape record.



Effects of attention condition (divided vs. focused) and of type of non-target on target detection. Data from Johnston and Wilson (1980).

Picture 11 - Divided Vs Focused Attention Performance *(adapted from Pashler, 1998)*

Salame and Baddeley in 1982 found that “irrelevant speech disrupts immediate memory for visually presented materials”.

On those two experiments, investigators tested in which way an auditory irrelevant stimulus interfere with the main task of visual modality. We did the opposite, testing the interference of a visual distraction on the main auditory attentional task and we tested it under a divided attention task, as individuals had to process the distracting stimuli (following the Light movement with one hand).

Divided Attention may occur with Serial Processing or Parallel Processing.

Serial processing happens when we push the limits of speed and efficiency of processing capacity by inputting several stimuli at a time but from one same sensory modality, (the same channel).

On the other hand, Parallel Processing is present when the individual can process one stimulus without needing to wait for the other stimulus analysis to be concluded.

Our experiment achieve the Parallel Processing on segments 2 and 4, as individuals could manage to follow the light distraction with one of their hands while at the same time, were able to click the Biopac hand switch every time they heard the sounds stimuli.

And, once again, results suggest a positive trend effect of Qigong training over the enhancement of that Attentional Mechanism.

What happens with our experiment is congruent to Townsend writings in 1974, he said that “mental operations might occur simultaneously, but each might operate more slowly when other operations are under way at a given instant than would otherwise be the case”. The good news about this study is that Qigong training of only 5 minutes long has been capable of augmenting the velocity of individual's response even with another mental operation occurring at the same time. In fact, it was the pick performance segment for the professional experimental group.

This effect will be better explained on Qigong Chapter while reviewing several scientific studies’ conclusions about this theme.

In the late 1960s and early 1970s, *Auditory monitoring tasks* were the subject of systematic research by several investigation groups. Those were *Intramodal* studies, as all of them in some way analyzed what happens when individuals have to divide their attention between two simultaneously auditory stimuli, one to each ear. [4, 3]

A question that keeps remaining with no strong and systematic researching conclusions is “whether stimuli in different modalities draw on the same single-capacity limitation”. (Pashler,

H., 1998) It has been found in at least one study (Treisman and Davies, 1973) that when the load is divided between modalities, performance is better than when everything is concentrated in the same modality.

3.2.2 Bimodal Selective Attention

When relating to reality, when, 24 hours a day, we are absorbing sensory stimulation from several modalities simultaneously, it is quite surprising that classical experiments didn't test that much the influence and effects of more than one sense modality at a time. But in fact, has we already mentioned, most of those studies are about visual Attention/Perception and space localization. The other few are about Auditory Processing. Studies testing or using both visual and auditory stimuli together are rare.

Driver and Spence (1994) carried out an experiment to check if people are capable of selecting auditory stimuli from one part of space while they select visual stimuli from the other part. A significant decrease in shadowing performance (auditory task) occurred when the visual display was on the opposite side to the speaker.

Alfonso (1992) performed similar experiments using a slightly easier shadowing task and he found a trend in the same direction.

However none of them recorded reaction time to measure whether intermodal stimulation decrease or not the individual's performance. So we would be happy to know that the present study may do an extra contribution to that field.

Authors agree there is a need for further studies about how selectivity in different perceptual modalities is processed. "At present, evidence exists for some degree of obligatory linkage. On the other hand, it seems clear people can decouple selection in two modalities to a substantial degree, arguing against a single supramodal spatial attention controller." (Pashler, H., 1998)

3.2.3 Controlled Parallel Processing

Having concluded that neither of the classical theories is totally right, a new and more flexible theory arises: CPP.

This one emphasize that capacity limits and perceptual processing both characterize human perceptual processing.

This term is not so present amongst many attention books but, as Pashler, H. (1998) pointed out in his writings about Attention and Perception "it is a rather commonsensical view that often occurs to people when first encounter the issues posed by attention theories."

This theory claims that parallel processing of different objects is achievable, as defended by *early selection theory,* but it is optional, contrary to *late selection theory.* People are

capable of choosing whether they want to process just one stimulus at a time *or* more than one at the same time.

According to the CPP approach, we should expect to find evidence of parallel processing in divided attention tasks where such processing would be advantageous.

Pashler, H. would be happy to know that the present study achieves congruent results to this assumption. Suggesting that (besides the truth pointed out in CPP theory) Qigong training is relevant to improve individuals performance in experimental conditions requiring that neuro plasticity processing advantage.[4]

3.2.4 Central Processing Limitations in sensorimotor tasks

Capacity Theories

There are two principal ideas that resume those theories:

1) processing in two tasks operate in parallel, having its efficiency conditioned to the amount of resources allocated to them

2) individuals can, at will, vary that allocation. [4]

"The results of several recent studies support a modified CPP which stipulates that when the total complexity of perceptual processing is exceeded, capacity limitations emerge." (Pashler)

Neural Theories of Dual-Task Interference

Those made a lot of sense and had been largely and easily proved by neuroscience and its studying of neural structures and their functions. One interesting idea, proposed by Kindsbourne (1981), was that "the ease with which tasks could be combined depended on the physical distance between the cortical circuits that carry them out." Friedman and Polson (1981) proposed that the left and right hemispheres constitute at least partially separated pools of processing resources. This theory postulates that it should be easy to do a pair of tasks that are allocated each one to a different hemisphere (task 1 to right hemisphere and task 2 to left, e.g.).

3.2.5 Focused Auditory Attention

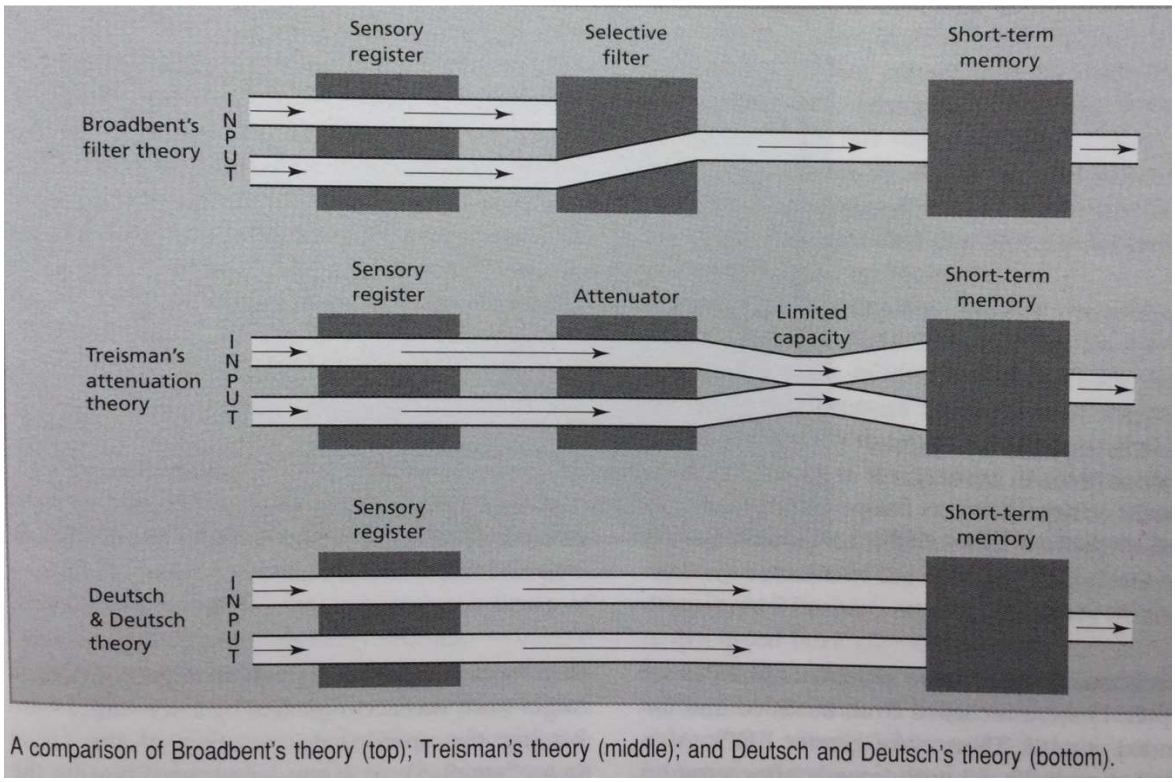
Amongst all the classical experiments done in this particular field of Attention, two general questions ruled investigations purposes:

1) What type of processing occurs regarding unattended stimuli (Unattended stimuli are processed or not at all? If so, in which level and what characteristics are processed for unattended stimulation?)
2) Selection takes place as an earlier mechanism, as argued by Treisman and Broadbent or just later on the short-term memory as defended by Deutsch & Deutsch?

Answering the first question, most of the investigations found that depending on some characteristics of unattended stimulation, it does happen to have some minimal processing. A curious experiment made by Von Wright, Anderson and Stenman (1975) demonstrated clearly that even when the individuals weren't capable to reproduce or describe the unattended stimuli they develop a physiological reaction (galvanic skin response) in the presence of unattended stimuli (words) that were earlier related to an electric shock on the non-attended list.

For the second question, neurophysiological studies provided support for early-selection theories. Event-related potentials (ERP's) were greater to attended than unattended auditory stimuli about 20-50 milliseconds after stimulus onset. "Thus, there is more processing of attended than unattended auditory stimuli starting from the initial activation of the auditory cortex." (Eysenck, 2000)

Thus, the most reasonable account of focused auditory attention may be suggested by Treisman (1964), as he pointed, with reduced or attenuated processing of sources of information outside focal attention. "The extent of such processing is probably flexible, being determined in part by task demands" (Johnston & Heins, 1978).



Picture 12 - Comparison of Broadbent's, Treisman's and Deutsch and Deutsch Theories

(adapted from Heysenk)

3.2.6 Vigilance and Awareness Mind Mechanisms effect

"Attention clearly can be divided among channels, but under the assumption of the unity of conscious awareness, the perceived contents of the attended channels should be somehow integrated or combined." (Cowan, N., 1997) Thus, stimuli that can be consciously perceived simultaneously can be compared to one another, as awareness serves as a "global workspace" (Baars, 1988).

So if a person is able to describe the stimulus, she can report it through multiple response modalities and can recall it, awareness of it might safely be assumed. [32]

During our experiment, individuals were able to listen to segments of sounds, recognize and describe the sound and press the button of the biopac hand switch as a response. Thus, there's no doubt that awareness mechanism was therefore activated.

Vigilance or *sustained attention* ensures that goals are maintained over time. The neurologist Norman Mackworth defined vigilance as a "state of readiness to detect and respond to certain small changes occurring at random time intervals in the environment". In situations that requires maintaining the attention levels through time, the quality of attention proved to be fragile as it declines over time – an outcome known as the vigilance decrement. (Davies and Parasuraman, 1982)

3.2.7 Attentional Set influence

Another classic issue in the study of Attention is the *Set* influence over Attentional mechanisms. Investigation in that field proceeds to answer "whether having advance information about a stimulus can help one perceive that stimulus more effectively."[4] In a certain fashion, the rhythm can be processed as advance information about the stimuli.

"Benefits of advance information about stimuli have often been termed perceptual set effects. The word ***"set"*** has been used in different ways for a long time (see Gibson, 1941, and Haber, 1966 for discussions of early literature). The idea behind this term is that people may be able to set their perceptual system to process certain stimuli or carry out certain discriminations more effectively than would otherwise be possible." [4]

In a general form, advance information of a stimulus can be provided in two ways:

1) By *cueing,* giving explicit information about stimulus attributes.

2) By predictability, a relevant attribute of the stimuli is held constant. This happens in our experimental segments 3 and 4 where there's a rhythmic cadence of sounds that might help individuals to predict and stay more alert to the time of occurrence of next stimulus.

The mechanisms of set effects were traditionally well studied by Cognitive control issues in a general fashion but few experimental procedures were done related to its specific role in Attention. And, as a general tendency earlier mentioned in the present study, there are much more work about Visual Attention than about Auditory Attention. Our study is conclusive about the set influence on the improvement of the reaction time when there is a rhythmic cadence of the sounds stimuli sequence.

Despite all the empirical disagreements about Set influence, there aren´t any doubts within the scientific community that "when an observer has to carry out a detection or discrimination involving a difficult-to-hear stimulus, prior information about the stimulus can often improve performance substantially, whether measured in terms of accuracy or speed. Advance information can therefore be said to facilitate perception in the broadest sense, but is not so when perceptual facilitation is defined more narrowly. " (Pashler, H., 1998)

3.2.8 Auditory-Visual Spatial Interaction

Although there is large evidence that separated brain mechanisms and processes may be located individually accordingly to each feature of the stimulus (e.g. color, shape, location…), we also know that mechanisms of feature-integration operate to make us see and feel the world with coherent representations.

For example, when we make a dance, the perceptual system has to integrate motor, proprioceptive, auditory and visual senses. "Such integration across the senses has been variously labeled the problem of pairing (Radeu and Bertelson, 1977; Radeu, 1994), binding (Pourtois et al., 2000), object identity (Bedford, 1999), or the unity assumption (Welch and Warren, 1980)" (Gelber, B. et al., 2001)."

To explain the Cross-Modal Pairing problem there is a phenomena described as the "ventriloquist illusion" [2]

"The ventriloquist illusion is created by presenting auditory and visual stimuli synchronously in somewhat separate locations. The most important effect is a cross-modal bias, which occurs when a subject s instructed to localize the sound while ignoring the spatially discordant input in the visual modality. Usually, the perceived location of the sound is shifted in the direction of the visual stimulus" (Gelder, B et al., 2001)

This effect was named under the ventriloquism concept because it is a great example of how the auditory and visual stimuli, when presented as a single event, may cause the illusion that the voice comes really from the puppet's mouths.

The fact that vision bias audition may indicate that the perceptual system has treated the auditory and visual stimuli as a single event. [2]

In one of our experiments, we trained subjects to discriminate a sequence of tones that emanated either from a central location or from alternating locations, in which case the tones were emitted by two speakers, located on either side of a computer screen (Vroomen et al., 1998). With their eyes shut, this was a very easy task. This task has proved more difficult when light flashes were presented on a screen that alternated in synchrony with the sounds that were being emitted between the left and the right sides on a screen. "This condition created the strong impression that sounds from the central location now alternated between left and right, presumably because the light flashes attracted the apparent location of the sounds." (Gelder, B. et al., 2001)

In a multi-sensorial world it is rather important to study and understand cross-modal integration than a single sensory modality effect.

As it is so clear that, except under laboratory controlled conditions, one is always submerged with multiple channels and diverse types of stimulation. There was out motivation to study response time not only in a focused auditory task but furthermore in a cross-modal circumstance (adding a visual distraction).

Besides that, animal studies led to neurophysiological evidence indicating that cross-modal interactions can occur at very early stages of sensory processing.[2]

Probably one of the best known sites of multi-modal convergence and integration is the superior colliculus, a midbrain structure known to play a fundamental role in attentive and orientation behavior (see Sten and Meredith, 1993, for review). In humans as well, neurophysiological evidence of very early cross-modal interactions has been found. (Gelder and Vroomen, 2000) (Gelder, B., et al, 2001)

Perceptual evolution in one sensory modality may produce consequences in other modalities in order to maintain coherence.

Conclusion

One unified and central attention system or a diverse multimodality systems according to each sense?

It may sound obvious that the findings described on the above mentioned types of attention conceptualize it either as an exclusionary process or as a "pool of resources" (Pashler, H., 1998) capable of allocation from different channels or stimuli sense modality.

While trying to define a general concept of perceptual attention there's a question that emerges: "whether there is separate perceptual attention systems associated with different sensory modalities, or a unified polymodal attention system. Should we speak of visual attention and auditory attention, or are these really the same thing?" (Pashler, H., 1998)

As discussed above, there are evidence that people appear capable of selecting visual stimuli in one part of space and auditory stimuli in another part. In fact, our experimental segment 2 was designed under this assumption and all the individuals participating on the experiments were able to achieve the two tasks simultaneously.

However, this was the segments with worst reaction times at the assigned task, at least at a baseline data recording (before the Qigong training). Leading to the thought that capacity limits recognition appears to be more severe while processing multiple stimuli presented through a single modality than through multiple modalities.

Both of these results tend to favor modality-specific perceptual attention systems. On the other hand, modality specificity may be a "graded" (Pashler, H., 1998) rather than absolute property.

"Characterizing a system as complex as the brain in information processing terms is by its very nature a great simplification." This Pashler statement written as a concluding comment of his book *"The Psychology of Attention",* summarizes and explains why there are so many Theories about Attention mechanisms and systems but despite their valid contribution we remain without a general agreement or, at least, a continuum of analysis where we may reasonable understand how and where new findings can integrate.

As a general conclusion taken from all the diverse studies about Attention and Perceptual Mechanisms, one can allude to the fact of the enormous mental flexibility. Neuroscience and Neuropsychology have tremendous empirical and scientific data proving that well-known assumption.

Neisser (1976) was brave to say that "human information processing is so enormously flexible that the research for simple processing limitations is hopeless and misguided".

Attention issues are being studied from different Sciences like Cognitive Psychology, Neuropsychology, Neurosciences, Neurophysiology and Biology.

All of them with great findings to achieve the never-ending goal of totally discover the "human mental machinery". (Pashler)

However, all those investigations allow us to help more and more patients with disorders and affections of limited performances and just for that purpose it is most important to keep going further.

3.3 Variables of Influence in Attentional Systems

- Novelty or unexpected stimulation:

  the tendency to shift attention in the presence of stimuli that are new or unexpected is a possible involuntary influence fairly understandable by common sense examples such as an unexpected loud noise while we are sitting on a library. Or, in an opposite scenario about intensity, imagine an industry with loads of loud machinery running all day long; if suddenly occurs a big silence, workers might stop their tasks trying to find the cause for this infrequent lack of noise. (Hinde, 1966, Rohrbaugh, 1984, Sokolov, 1963, Berlyne, 1957, Waters, McDonald and Koresko, 1977, Similarly, Lorch, Anderson and Well, 1984, Cowan, 1988)

- Emotionally charged stimuli:

  every human being has experienced several times the magnitude of influence that emotions are capable of. The effect that is most widely interpreted as evidence of orienting to emotional stimuli is the so-called "*emotional Stroop effect".* (Eysenck, 1992; Mathews and MacLeod, 1985) In their studies, subjects attempt to say the color of a word as fast as they can. Anxious Individuals often response slower to emotional words (e.g., panic) than to non-emotional words (e.g., flute). [4]

- Stress:

  the effects of stress on human (and animal) performance has been largely documented by different sciences, as well as the relationship between a person's psychological state and health impact. Broadbent´s et al. (1984) demonstrated that "introverts show a higher degree of infection than extraverts when challenged with a cold-producing virus". They also found that obsessive symptomatic people produced more nasal secretion than volunteers with colds but with low scores on this scale. Just to picture out how Psychotherapy in Traditional Chinese Medicine (PTTCM) have valuable expertise comprehending this psychoimunological phenomena, one may analyze Broadbent's findings as following;

  a) Introverts are pulmonary or renal constitutions people (in terms of personality-orb related types), so accordingly to the Heidelberg Model sinus-wave of Phases ***(see***

picture 3 on Chapter I, Point 1) they either are located at the Metal (pulmonary) or Water (renal) phases. Both are in *Yin* (internal) mode – parasympathetic functions **(see picture 2 on Chapter I, point 1),** whereas the body is storing energy to rhythmic vital functions, such as breathing, peristaltic movements, etc., and, on the water phase, regenerating functions, tissues and organs at its maximum level. So, the immunological system should be more alert and defensive.

On the other hand, extravert's individuals are part of Wood or Fire Phases as they might mainly correspond to Hepatic or Cardial/Pericardial constitutions. As the reader observes on the sinus wave, both phases are *Yang* (external) – sympathetic activity – **(see picture 2 on Chapter I, point 1)** and therefore characterized by high levels of activity and spending energy. In addition, one may remember that Hepatic's and Pericardial´s people classically are related to high stress levels and burn-out affections. In those conditions, the body is more vulnerable to infectious attacks. We may also note that, Broadbent´s and his colleagues mainly studied "cold-producing" types of virus when finding the above results. Once again, Chinese Medicine main Theory of Cold invading the body, well-known as "Algor Leadens Theory", assumes that when cold first entrance the body, the three first stages (yang major, splendor yang and yang minor) are characterized by a wood/fire constellation of symptoms like cramps, humor and pituita blockages (congestion of upper respiratory system) and changing temperature sensations resumed as the "hot-cold-nausea-phase, on stage 3.

b) They also found a relation between obsessive symptomatic people being more prone to nasal secretion that is fairly demonstrated by PTTCM when theorizing about *cogitation* personality people. This phenomena of worrying too much and stuck on thinking and keep thinking about a problem or a situation endlessly have so much in common with obsessive thinking that it is not wrong to say it is almost the same process. As TCM professionals know, *cogitation* is ruled by the Earth Phase. And this phase has the Stomach and Lienal Orbs and Conduits, with their functions totally related to digest (also "digestion" of emotions) and distribution of fluids and the lymphatic system processes. When those orbs or conduits have a blockage the main symptoms are secretions, congestion, concretio (when pituita is

added) and edema. PTTCM emphases the fact that a non-digested emotion or though will tendency to produce cogitation and it is a matter of time to produce, therefore, blockages on stomach and lineal functions.

- Viral Illnesses:

inspired by this demonstrated link between stress and infection vulnerability, a more recent study of 1991 done by Cohen, examined what effect viral infections has on performance. This study leads to large interest on the scientific community and loads of data was examined with the support of the Common Cold Unit. Most of this research fits in one of the two lines of investigation; the first about upper respiratory viral infections (colds and influenza) and the second research to understand which behavioral problems occur as a consequence of the first viral illnesses in a phenomenon known as the post-viral fatigue syndrome. Investigators general conclusions pointed that the magnitude of the effects over performance depends on the type of virus and the nature of the activity being carried out. They also agreed that those effects happen not only during symptomatic time but also before and after that period.

- Alcohol, drugs, psychotropic medicaments and other substances:

the intake of substances have several empirical, common-sense and scientifically researched effects over all the mind basic mechanisms.

- Cognitive-energetical control mechanisms:

the Brain as the “motor” of nervous system is the organ that more energy consumes to function, some individuals develop better than others the skill to save more energy during cognitive demanding tasks, on the other hand, some are able to better canalize the energy to attention needed tasks.

- Personality Individual differences and motivation;
- Emotions and it selective effects over information-processing.

4. Cognitive Neurosciences – Prospects for further advancement

As a tacit conclusion resulting after reading the diverse approaches and theories about Attention, on section two of the present Thesis, the central paradigm is that Attention is not a single entity but the name given to a finite set of brain processes that can interact, mutually and with other brain processes, in the performance of different perceptual, cognitive and motor tasks.[2]

Therefore, it’s useless to search for a single definition or even an integrated theory of Attention. However, in very recent years, Cognitive Neuroscience with its new methods had been giving significant contributions to a better and longer comprehension of this

theme “whereas behavior studies have been useful in identifying the functional characteristics of Attention neuroscience studies have enable further examination of how and why those functions are implemented in the brain” (Parasuraman, 1998).

According to the new Paradigm, studies using event-related brain potentials (ERP’S) have clearly shown that selective attention modulates early-latency ERP components, both in the visual and in the auditory modality, providing reliable evidence for the Early Selection and conditions under which it occurs (Eason, Harter and White, 1969 et al).

“Additional research should clarify whether the anterior cingulate or other higher phenomena can be explained without the need for such mechanisms. Whatever the outcome, the cognitive neuroscience paradigm has redefined the debate using more tractable questions that can be pursued empirically “ (Parasuraman, 1998).

5. Reaction Time - Mental Chronometry

Experimental and Cognitive Psychology was a precursor science in the defend of the usage of Mental chronometry as one of its core paradigms since the beginning.

Various disciplines including cognitive psychophysiology, cognitive neuroscience and behavioral neuroscience had been using Reaction Time measurements to elucidate mechanisms underlying cognitive processing.[34]

5.1 Definition

“Mental chronometry is the use of response time in perceptual-motor tasks to infer the content, duration, and temporal sequencing of cognitive operations.” (Jenses, A. R., 2006)

Mental chronometry is being studied using the measurements of reaction time (RT).

“***Reaction time*** is the elapsed time between the presentation of a sensory stimulus and the subsequent behavioral response. In psychometric psychology it is considered to be an index of speed of processing.” (Jensen, A. R. (2006)

In turn, speed of processing is considered an index of processing efficiency. The behavioral response is typically a button press but can also be an eye movement, a vocal response, or some other observable behavior.[34] On the present study we used the “button press” as the response form.

5.2 Implicit Method for Auditory Attention Measurement

Attentional mechanisms are subject to several individual and circumstantial variables, mind mechanisms involved are not totally pragmatically defined and the brain neuroplasticity is well-known by the scientific community. To quantify such a complex phenomenon has obvious challenges.

However, as Cowan, N., 1997, pointed out “One cannot totally control the subject’s attention, but one can observe attentional effects obtained through instructional differences between conditions”

In the current study, to measure those effects we have chosen to control reaction time differences between the four experimental conditions described in Chapter III.

CHAPTER II

Qigong

6. What is Qigong

It is a traditional neurovegetative biofeedback therapy which allows voluntary and conscious control of the body processes. It integrates postural exercises with breathing and interoception (feeling of self, inner-body and its mechanisms and reactions). By doing that, it is recognized for several health and performance benefits such as:

- Regulation of the parasympathetic and sympathetic nervous systems
- Reducing physical and emotional imbalances
- Improving the immunity system
- Improving muscular and aerobic capacities

"Qigong refers to those exercises that try to generate and circulate Qi within the body... And usually involve techniques of breathing, stretching, and a calm mind to visualize and guide the Qi through the body." (Tow, M., D., 2013)

Qigong as a *mind-in-body* therapy, based on the fundamental concept of gathering and filling the Qi (bioenergy) inside the body, have irrefutable empirical benefits in a large variety of Health problems and most frequently related to stress management, positive effects on emotions and cognitive performance enhancement. In the following pages we will review the literate and scientific studies about that so beneficial therapy.

6.1 Chinese Medicine Vision - The Origins

Qigong principles are grounded in TCM that dates back 3000-4000 thousands years B.C. Nevertheless being such an ancestral healing therapy, the research boom looking for systematic, observable and quantifying scientific results began in the early 1990s. That made possible to develop it as a unique discipline with a very well organization of its theories and methods, now known as Chinese Medical Qigong (CMQ).

When writing about Qigong it's compulsory to explain Chinese Medicine Principles.

Qigong Roots

The concept of Qi (energy) and Gong (skill) seems to first appeared during the Jin Dynasty (265-420 AD), used by a Daoist one. Being Daoists mostly interested in "understanding the nature of reality, increasing their longevity and regulating consciousness and diet (Rahner. K. et al.) it is quiet logical their early relation to Qi work.

Thousands later, the term "Qigong" come into formal usage, after the foundation of the People's Republic of China whereas the term appeared, in Hebei Province with the "Tangshan Qigong Sanatorium". "Since then it has been used in the practice and literature of both clinical Chinese medicine and personal health care." (Chen, Kevin W. et al., 2010).

During the 70's Qigong became so popular that it was called "the Qigong fever" years.

After the 1980s, with the open-door policy in China, Qigong was widespread around the world. And, as the present study witness Qigong is nowadays an international phenomenon.

A concept with such a long history, of course have several definitions and some specificities according to each school.

As one of the first written references about Qigong appears in Daoist scriptures, ans also for personal related reasons, we choose to classically rooted it definition and main characteristics from the lens of that school.

Daoist Qigong taced back to the ancient Qin Dynasty philosophers Laozi and Zhuangzi.

Zhuangzi expanded Laozi's theories and it is of his authorship the very famous principle of uniting heaven, man and earth into one; "Heaven and Earth exist with me; the universe and I are one", he wrote on his book "Qiwu Lun".

For this Theory, it is crucial to develop the "body's three treasures":

- Jing (vital essence/marrow/ADN)
- Qi (energy/vegetative function capacity)
- Shen (mind mechanisms/mental presence)

Summarizing, Daoist Qigong is a "discipline that cultivates body and mind simultaneously…which means guiding the flow of internal energy (Qi)". [W1]

For a universal/scientific comprehension of the term, Chen et al, in 2010, advanced a concise and direct definition; ***"Qigong is the skill of body-mind exercise that integrates the three adjustments of body, breath and mind into one."***

"Adjusting the mind plays the most important role among the three. TCM believes that the heart (Xin = Heart/Mind) governs the spirit (Shen) and is the master of the five-Zang and six-Fu organs. Adjusting the mind can calm emotional fluctuations and bring balance to the autonomic nervous system. Traditionally,it is said, when the "master" (Xin, Heart/Mind) is judicious, the "subordinates" (organs and functions) will be obedient accordingly and function coherently.

The result of mind adjustment cultivates the conscious capacity to regulate the emotions and the nervous system, which then spontaneously regulates the fiveZang and six-Fu

organs, as well as the whole body. Experimental studies have shown that, while entering tranquility, electrical activity of the neurons of the parietal lobe and frontal lobe of the brain tend to become more synchronized.

This indicates that Qigong practice can adjust the central nervous system, and enhance its regulatory influence on the whole body." (*Chinese Medical Qi Gong*, Chen et al.)

6.2 Qigong proved benefits

Tow, have made a resume of the most well documented results of studies published on the "*Chinese Medical Qigong",* a relevant book from 2010.

As it helps us to aware the reader about the diversity of proven benefits we will briefly describe some of them.

1) Larger Diaphragm movement;

   An increase in the amplitude of the diaphragm's movement was observed by x-rays for Qigong practitioners. This effect benefits breathing and Lungs performance but also the gastrointestinal peristalsis and blood circulation, as a larger diaphragm movement exerts a stronger massaging effect in all the abdominal cavity internal organs.

2) Increase in Alpha-wave amplitude;

   EEG measurements have shown an increase in the alpha-wave amplitude and a decrease in its frequency, which indicates tranquility state tendency.

3) External Qi inhibits tumor growth in mice;

   External Qi (EQ) is the usage of Qi applied by a healing expert to produce medical benefits in another person. To avoid the argument of placebo psychological effect, researchers used mice with cancer (as they will not be conscious of their medical condition and treatment applied) and results shown that Qigong-treated mice had an effect of inhibition of the tumor that didn´t occur on the mice-control group.

4) Psychological effects;

   Application of various psychological scales found that Qigong practitioners are significantly better in many psychological indexes such as depression, anxiety, interpersonal relations and hysteria, amongst other. The benefits were so exciting that Qigong is now increasingly done as part of Psychological Therapy in the USA.

5) Physical Measurements of the External Qi effects;

Infrared measurements was recorded in both the Qigong master and the receiver person, this study found that infrared intensity increased at palms and arms of both when Qi was being emitted. It is also curious that parts where the receiver related to feel sensations were the parts where increased infrared radiation intensity appeared.

A different study analyzed photon emission from the abdomen and the head of a Qigong healer and found that the emission levels were many times higher than that of the ordinary human.

6) Physical Measurements of the Internal Qi effects;

Like the pioneer experience of Luis Matos, 2011, bellow illustrated.

Another study from 2010, with a randomized controlled neuro-electrophysiological research, showed enhanced temporal alpha asymmetry (and index of relaxation and positive mood) after performing the "Passive Dan Tian Breathing" Technique during five minutes. After training the "Active Dan Tian Breathing", equally for five minutes, occurs an enhanced on the intra and inter-hemispheric theta coherence (an index for attention and alertness). While both breathing techniques activated the middle frontal and temporal gyri, the Passive form elicited unique activation in the cingulate gyrus whereas the Active training produced activation in the bilateral amygdala and Parahippocampal gyri. Those brain regions are crucial for mediating emotional, attentional and memory processing. [35]

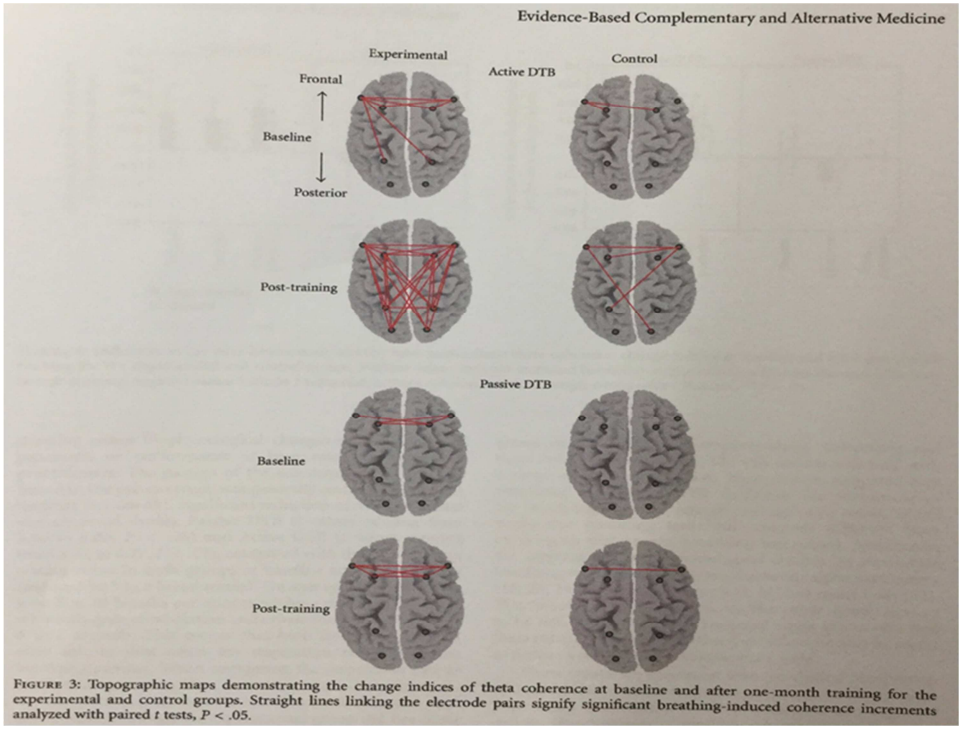


FIGURE 3: Topographic maps demonstrating the change indices of theta coherence at baseline and after one-month training for the experimental and control groups. Straight lines linking the electrode pairs signify significant breathing-induced coherence increments analyzed with paired t tests, $P < .05$.

Picture 13 - Topographic map with theta coherence after 1 month Qigong practice

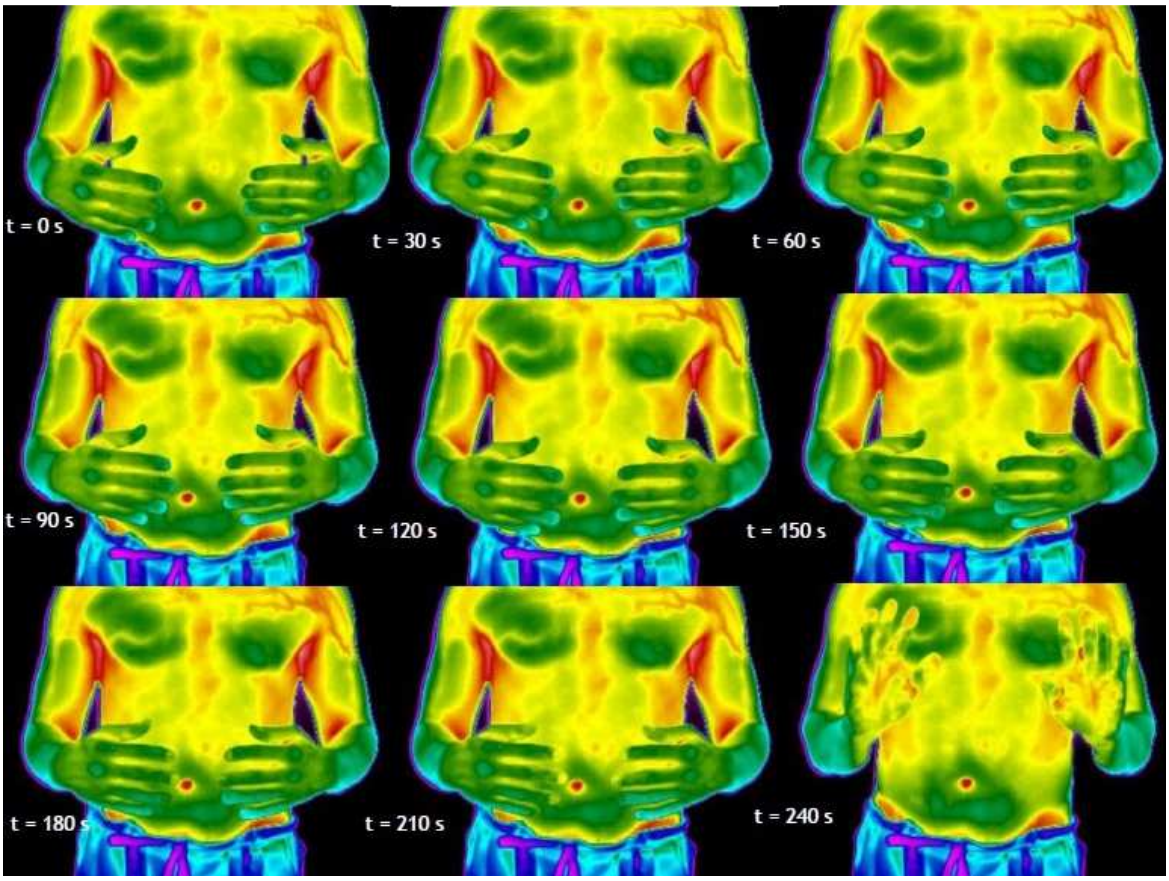
[adapted from Parasuraman,2008)

Those findings are congruent with the common perceptual feelings and sensations largely described by Qigong practitioners as the effect of their trainings. [37] Furthermore, some empirical studies have suggested that "enhancing both a relaxed and an attentive mind states is crucial for achieving higher cognitive performance, such as enhanced attention and concentration, faster reaction time, better decision making ability, and increased creativity, and thereby improving work efficiency and productivity." (Chan, S., A., et al. 2010)

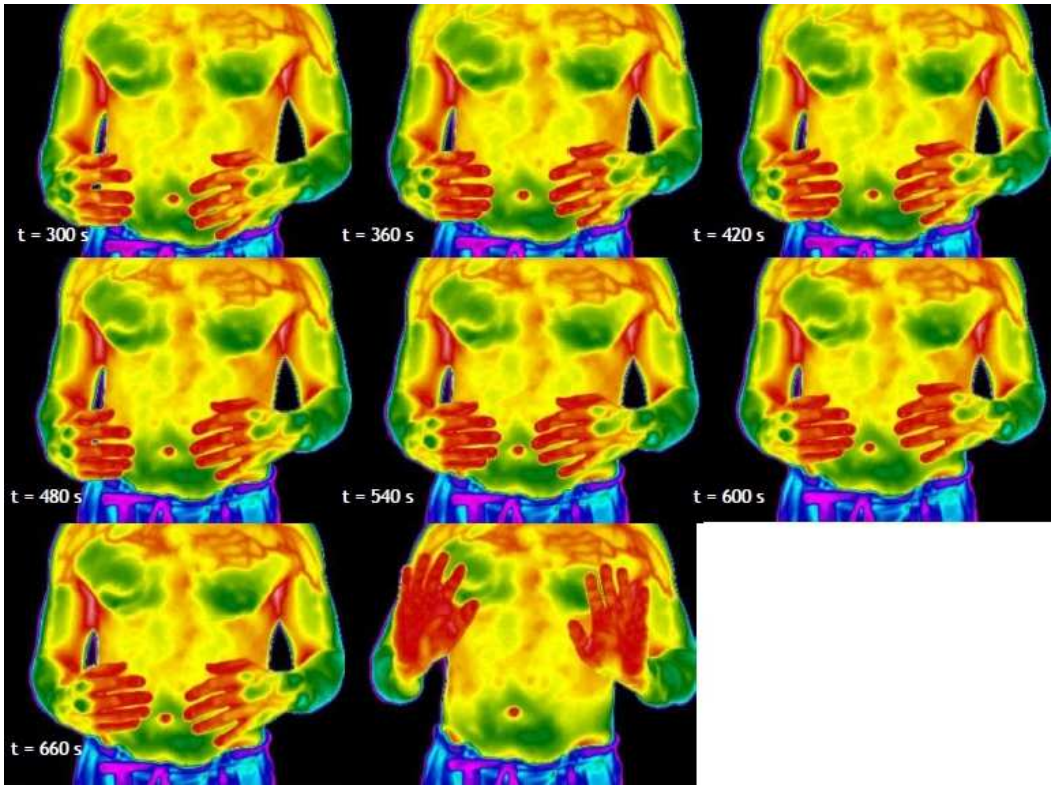
These double effects of attentive and relaxed state simultaneously inducement is the dream achievement of any psychological therapy or psychotropic medication. However it is very rare to obtain. As one might deduct it is, by that, a great fact that a five- minute Qigong is capable of obtaining it that easily.

The current Thesis study found identical assumption, as reaction time in the professional experimental group was faster in all the four experimental conditions. Being of even better interesting, the evidence that our subject's best performance was obtained in the most difficult experimental environment: the divided attention of cross-modal task difficulty type with aleatory rhythm cadency of the sounds.

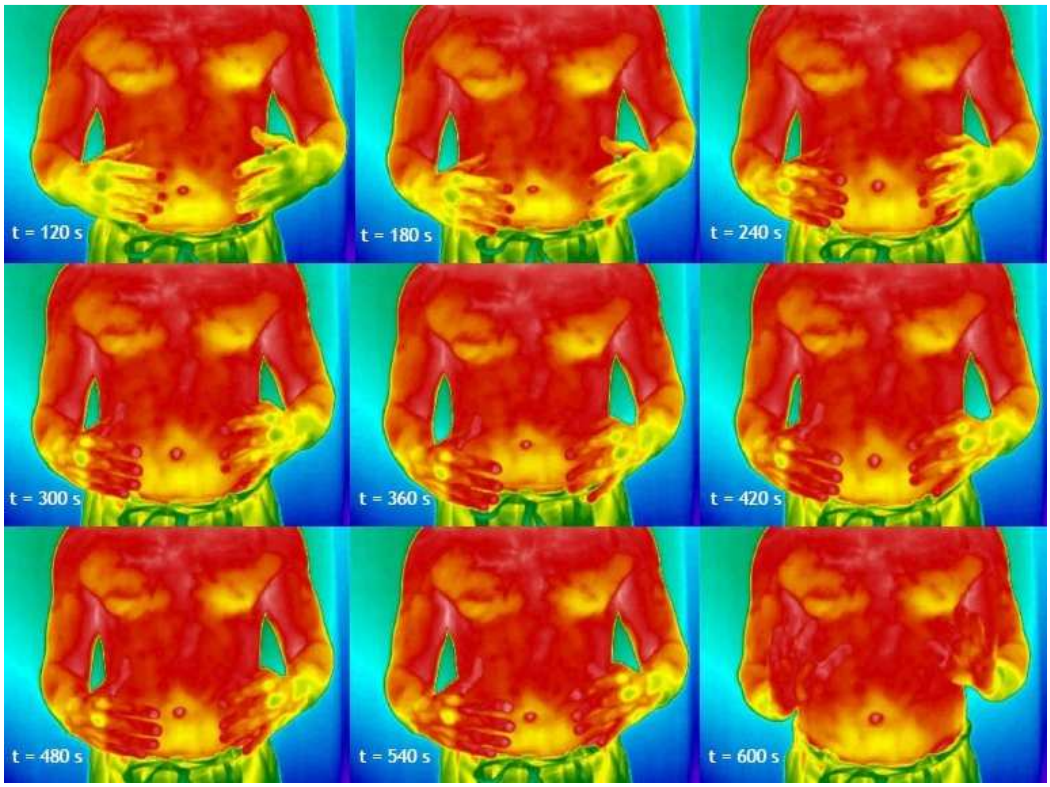
Luís Matos, in 2011, had conducted a study specifically to measure Qigong effects recurring to infrared thermography room equipment and also measured the difference in electrical potential. Both measurement tools registered statiscally significant and observable changes.



Baseline/placebo control: standing position with holding the ball while seeing a movie**.**



Clinical Experience – Real Qigong training with regular breathing



Clinical Experience two – Real Qigong training with abdominal breathing

Pictures 16, 17 and 18 **-** Luis Matos Master Thesis Recordings with Thermography Equipment
(adapted from Matos, L., 2011)

A study of 2011, conducted by Pascal L. Faber and colleagues, recorded brain electrical activity with multichannel EEG source imaging during their meditations. They performed two different exercises; "Qigong" and "Thinking of nothing" meditation.

Analysis of the activated areas and related to beta-1 and alpha-2 frequencies led to the below conclusions.

"Qigong showed activation in posterior areas whereas *"Thinking of nothing"* showed activation in anterior areas. The stronger activity of posterior (right) parietal areas during *"Qigong"* and anterior (left) prefrontal areas during *"Thinking of nothing"* may reflect a predominance of self-reference, **attention**, and input-centered processing in the Qigong meditation and of control-centered processing in the *"Thinking of nothing"* meditation."

Several studies have reported changes in attentional processes due to meditation practice. [42] Although Qigong is pretty more than isolated meditation, one of its main purposes is to activate and calm ***Shen*** (mind). So it is not rough to categorize it as a meditative training (as a mental discipline) considering it as having the aim to put the "mind-in-the-body" of its practitioners.

For that reason, one might expect that Qigong practice may be capable of similar (or at some point related) effects as other meditative forms.

A recent literature review shows that "meditators" are better than control groups at:

- Decreasing attentional blink
- Improving their ability to control perceptual rivalry
- Reducing distractibility
- Having more sustained attention
- Showing lower activations to Brain regions related to distraction and task unrelated thoughts
- Enhanced ability to focus attention thereby reducing the effects of irrelevant stimuli [42]

A literature review, 2013, was done by Don Tow, resuming the last 20 years of scientifically proven benefits of Tai Chi and Qigong. According to the relevance for the present theme we will just analyze evidence about Qigong. Tow's first paragraph about Qigong was to briefly define it as referring to "breathing, stretching, and meditative exercises that date back much earlier than Taiji". Following, he pointed out about the needed to before any further consideration explain some basics about TCM and Qi concept. As far as we read amongst all articles and books all of them refer the need to explain, at least, some basic concepts of TCM before even introducing what Qigong is about. Thus, we observed that it was not by luck or occasion that our experimental results found of majority importance the knowledge about basic TCM. In fact, the expectable performance improvement was only achieved by TCM students, despite all the instructions and guidance having been far identical to the conventional medicine students. Congruent to that assumption is the empirical fact that all the many people worldwide practicing Qigong on a regular basis claimed that "Qi is as real to them as their breath, their heartbeat, their conscious mind. They can feel the Qi In their body." [37/40]

It might be difficult for a TCM and Qigong naïve person to believe in those reports however, thanks to the last scientific research, we now have irrefutable evidence that made it so measurable and tacit that disarms any skeptical one.

7. Mind-Body Training in Psychology and other Western Approaches

It is a very usual topic, nowadays, the relation between body-minded techniques practice and better cognitive performances. Benefits on attention, multi-task management, stress

coping, well-being and general health improvements are largely documented. TCM and Eastern philosophy and lifestyles knew it since ever. As it might seem a recent boom for Western culture, psychologists had been alluding to that since the early 70's. Just to point some good examples, Ornstein (1972) did an interesting analysis of the role of attention in meditative practices, in his book "Psychology of Consciousness", Castaneda's (1974) in "Tales of Power" and Adam Smith (1975) in his "Treatment of Mind, consciousness and meditation".

7.1 Psychological Approaches - Western systems

Scientifically study of the effects of ancestral mind-in-body therapies such as Qigong, Yoga and Meditation are being developed enormously in the last two decades. However, Psychology, Physiotherapy and other Mind-Body Working therapies have been therapeutically using some of that Eastern cultural expertise since the earlier decades of the 20th century. While reviewing the Attention Literature, we found in Classical Psychology books, allusion to the importance of relaxation and awareness techniques (influenced by Eastern Meditation techniques) for people performance enhancement purposes. And those descriptions reported since, at least, 1950's.[33]

Considering that, it´s not surprising that one might found some key characteristics in common between some Psychotherapeutic Techniques and Qigong.

7.1.1 Systematic Desensitization

Systematic Desensitization is a psychotherapeutic technique much common used to treat phobias and anxiety/panic related responses. It has its roots on Cognitive-Behavior Psychology schools.

The aim of this therapy is to teach the patient how to do a relaxation technique, help him to feel and recognize when his body its totally relaxed and enjoy that feeling. The therapist give relaxation guidelines and induce the patient with verbal instructions to do deep breathings, feel every part of his body and muscles, one by one, starting to relax more and more while imagining an enjoyable and neutral-feeling environment picture such as a beach, a lake or a forest. The objective is to teach the patient body to relax and stay calm whenever the mind wants to order it.

After some relaxation teaching sessions, the psychotherapist ask the patient to slowly describe the context or the easiest characteristics of his phobia and imagining being confronted to that situation and, at the same time, induce muscular relaxation through breathing control and guided relaxation guidelines given by the therapist, as usual on the standard procedure firstly described.

From session to session, the patient will be challenging his own limits slowly augmenting details of his phobia in imagination and increasing the duration of that phobic image. When he starts to feel body anxiety responses such as heart rate acceleration, cold sweats, trembling, etc. the psychotherapist helps him remembering him about how to induce his body to a relaxed and balanced state.

The therapy ends when the patient successfully imagine his phobia and at the same time is able to maintain the enjoyable feeling of relaxed body and mind.

Clinical follow-up shows the efficacy of this technique when the client is later confronted with the real phobia situation or environment and, is still capable to maintain the balanced desirable somatic response trained during the psychotherapy sessions.

7.1.2 Progressive Muscle Relaxation

This stress management technique was developed by Jacobson and it is a widely practiced relaxation method. It is well-known by its effectiveness in alleviating anxiety and mood problems. [36] Participants were taught to inhale when feeling muscular tension and exhale when relaxing. The psychologist should also alert the patients to be aware and feel the bodily changes and differences throughout the tensing/relaxing cycle.

As a standard procedure, we should start by making some deep breaths with closed eyes, followed by alternately tensing and relaxing groups of muscles in a prescribed sequence; from the head down along the chest, the hands and the feet. It has been suggested that training that produces both relaxed and attentive brain state will enhance individual's performance. [38/36] "For such a brain state enables individuals to get rid of distraction, remain focused on task, and cope with stressful work demand in a relaxed and flexible manner." (Chan, S., A., et al. 2010)

7.1.3 Feldenkrais Method

Moshe Feldenkrais was an Engineer and enthusiastic practitioner of Judo Martial Art.

It is said that it was his personal knee injury that motivate him to develop a new methodology of self-awareness movement technique.

Feldenkrais' methods are "somatic education techniques designed to establish a heightened awareness of movements". Jain et al., 2004

From his own experience he was able to practice Judo again and around 1950's he started to written about his methods and later did a course where himself had taught 65 students in a teacher-training program, at San Francisco.

He began a more than 2-hundred student training in 1980 but was only able to teach the first two years of four. For health reasons he had to stop it and passed away in 1984.

Nevertheless his work continued to spread and nowadays there are several researchers worldwide alluding to its effects in “improving a variety of physical and psychological parameters related to balance confidence and self-efficacy” (Stephens et al., 2001)

7.1.4 Alexander Technique

The Alexander Technique (AT) is "a taught form of physical therapy designed to correct movement over time and brings the body into natural alignment with the object of helping it to function efficiently" (Posadzki, P., 2009)

Key characteristics of the technique may be resumed as:

- Absence of effort and internal resistance with perfect movement's economy (it's a smooth technique as well as medical Qigong)
- Inhibition mechanism is taught as an opportunity to select your movement response from the wide range of available possibilities to the moment you have to commit yourself into movement's performance
- Primary control is another important issue that defines the basic alignment between the head, neck and spine and it is crucial in a person's balance.

From the postulated, some expected results derive:

a. Coordination of the All body
b. Achievement of the state of postural readiness
c. An expanded trunk (neck and back elongation) which facilitates synchronization of the limbs and the whole body
d. Reduced pressure on joints and lighter movements

Clinical effectiveness of AT, as a result of being a process of psychophysical re-education, is being promoted for several medical conditions such as; improved performance, improved physiological functioning such as breathing and pain reduction, enhancing balance, augmenting functional reach performance index, in Parkinson patients depression was reduced and the management of disability was significantly improved, improving pain behavior and disability in back pain patients and have a specially good effect for chronic back pain alleviation. [43]

All these benefits are explained by AT Theory as being the result of enhanced physiology; “congruence with the body’s intelligence or self-regulatory processes” leading to more adaptive and effortless movement patterns, increased performance’s efficacy and better movement’s economy and fluency.” (Posadzki, 2009)

7.1.5 Sophrology

Created by Alfonso Cayedo, a Spanish psychiatrist, in 1960's as an answer to help the Civil War Victims to back to a healthy physical and mental state without the usage of psychotropic drugs. Its techniques and methodology is the main approach of Health Psychology discipline. This one as the objective of promotion of Mental Health by preventive methods such as healthy diets and lifestyles.

Prof. Cayedo himself travelled to East to study Yoga and Buddhism in the search for the practices and core exercises that "speedily and effectively produced positive results".

Sophrology it's a method derived from the study of Harmony and Consciousness. Its objectives are "to produce optimal health and well-being". [w3]

It is composed by very simple physical and mental exercises and it is been empirically proved that when done with some regularity they "lead to a healthy, relaxed body and a calm, alert mind". [W3]

Dynamic relaxation is another term to define this exercises. The procedure described above in the Systematic Desensitization is based on the same type of Sophrology exercises. Besides the phobia/panic attacks treatment explained, Sophrology is used in many Swiss Hospitals "to prepare patients for surgical interventions, EMR scans and stress-free childbirth". [W3]

Conclusion:

A recent bibliographic review, done by Schmalzl, L. et al., in 2014, had grouped Qigong, Tai Chi and Yoga as "movement-based embodied contemplative practices" (MECPs) and concluded about its efficacy as modern somatic therapeutic techniques. Authors have used an integrative lens while comparing and finding some identity between those practices and western approaches such as the Feldenkrais Method and Alexander Technique.

As an introductory note they allude to the well-known benefits of movement-based practices over diverse clinical conditions (Jahnke, et al., 2010, Wren et al., 2011) and referred that changes in physiological stress markers are being measured in experiments such as the ones conducted by Lee et al., 2004 and West, et al., 2004. Enhancement of the cognitive functioning (Manjunath and Telles, 2001; Silva et al., 2007), sensorimotor acuity (Kerr et al., 2008) and alleviate emotional states in healthy populations (Chattha et al., 2008) were also described. [39]

Following the shifting tendency from abstract and computational views of the mind to a more embodied and situated views of the mind, Francisco Varela (Varela et al., 1991) was pioneer in introducing the "embodied mind" term into cognitive neuroscience.

He postulates that the enactive approach sees the human beings existing intrinsically as embodied beings and, therefore, mental functions as perception, cognition and motivation cannot be fully understood without reference to the physical body as well as the environment in which they are experienced. We may enrich his assumption by a practical example pretty well observable in the situation of children with Attention (Hyperactive) Deficit Disorders as well as the young ones struggling with Sensory Processing Issues; when they are just capable of being focus on tasks (those that specially require some time permanency) after some proprioceptive intense movement or even while keeping their bodies moving at the same time that they need to execute that cognitive challenging task. Recent empirical and scientific evidence had been showing that for the most of the population, even the neurotipicals, some movement or at least an upstand position while working our studying facilitates the learning process.

Picture 14 - Cycling Desk for AHDD children needs proprioceptive stimuli input

Picture 15 - Stand-up desk corner placed in a "regular" classroom for the integration of a AHDD student

These findings are easily understood from the viewpoint of sensorial integration theory. Occupational therapists defending that approach greatly emphaticized the vestibular and proprioceptive sensorial systems as being the basics that need to be "fed up" on therapy

sessions in order to accommodate easily the new sensory incomes and therefore facilitate the organization of high cognitive functions.

In sum, all these schools of thought converge on the fact that "the experience of one's self in the world as a cognizant being does not solely emerge from neural activity within the brain. Instead, it involves a complex interplay of brain, body and environment, and the seamless integration of interoceptive, proprioceptive (including vestibular), kinesthetic, tactile, and spatial information." (Schmalzl, L. et al.)

As a curiosity fact, it is interesting to know, on the pages of a Thesis where we aimed to find the effect of a MECPs over Auditory Attention that, accordingly to Partridge, 1966, the word "attention" is derived from the root "ten" ("to stretch out toward").

MECPs are based on internally generated self-willed movement (Krieghoff et al., 2011) and practitioners guide and adjust their movement based on subtle feedback from joints and muscles (Scott, 2012). In opposing to the general externally evoked or purely passively imposed motion (characteristic of other physical activated such as the ones practiced on Gymnasiums) MECPs have such a voluntary and actively initiated movement intrinsic to the sense of agency as defined by Kalckert and Ehrsson, 2012, that made it central to the developed of the sense of self (Thelen and Fogal, 1989).

In Qigong practice there is often a progression from an overt large motion to a very small and subtle one. And from that, advanced practitioners, would like to achieve a purely internal or imagined movement, as this last one is regarded as the most effective (as well as the most difficulty) way of moving "Qi" (bioenergy, life vital energy...). [39]

Therefore, is not strange at all, that Qigong has so many proven effects over emotional control and that several practitioners referred the training as an helping too in the searching and discovering of their innerselfs and personal realization achievement. [37]

A comparison between MECPs and Western Systems such as the Feldenkrais Method, the Alexander technique and body-oriented Psychotherapy was done by those same authors. As they allude to the similar occurrence of the "resonance" (Siegel, 2007; Nummenmaa et al., 2012) state in both perspectives. That state is achieved when two people (master and disciple, teacher and student or therapist and client) performed the training simultaneously in a way that together they may enter in a state of enhanced connectivity. These phenomena have been documented, in a social neuroscience research done by Singer and Lamn, 2009, by the simultaneous activation of affective and sensory brain structures in both individuals.

CHAPTER III

Experimental Study

8. Study Design

It is a Prospective Randomized Placebo Control and single Blinded study.

8.1 Objectives

1. Analyze the acute effect of a 5-Minute Qigong training on Auditory Attention
2. Compare the obtained reaction times of individuals when adding a visual distraction task
3. Relate those results to the following Psychological Attention theories:
    - Focused Attention
    - Divided Attention
    - Parallel Processing
    - Cross-Modality

    And contribute to a better understanding of the underlying mechanisms.

8.2 Hypotheses

According to Psychological Attention main Theories, we are able to characterize our experimental conditions as under the influence of the following assumptions.

Condition 1 - Focused Auditory Attention

Condition 2 - Divided attention of cross-modality task difficulty type with parallel processing occurrence.

Thus, relating those Theoretical assumptions with recent findings on Qigong research we hypothesized as follow:

Hypothesis 1: Five-minute "White-ball" Qigong movement shortens the RT, indicating an improvement effect over focused auditory attention, in experimental condition 1; individuals were to listen to a randomized interval sounds' sequence, with closed eyes.

Hypothesis 2: Five-minute "White-ball" Qigong movement shortens the RT, indicating an improvement effect over auditory divided attention of cross-modal difficulty type design, in experimental condition 2; still with randomized cadency of sounds, but open eyes plus visual distraction (following some LED lights movements with their other hand).

8.3 Research Question

We wanted to find out if a single five minutes practice of the WB Qigong improved perceptual Auditory Attention or a minimum training is necessary to obtain effects.

9. Methods

9.1 Samples and Groups

In a Universe of 10000 registered medicine students we were able to obtain groups with the following characteristics:

	Sample:	**Inclusion Criterions:**	**Exclusion Criterions:**
Phase 1: ***Control Group*** ***Randomized in Placebo*** **and** ***Experimental Amateur***	Done by 30 students of ICBAS (University of Bio Medics in Oporto), all of them registered on the second year of Medicine.	Healthy volunteers, registered on the 2nd year of Medicine, at University of Oporto.	Previous training or knowledge about Qigong. In a not healthy condition volunteers.
Phase 2: ***Experimental Group***	Done by 25 students or TCM professionals of the Specialization in Traditional Chinese Medicine from the same University.	Healthy volunteers with a minimum Qigong regular practice of 3 months. Registered on Traditional Chinese Medicine Specialization of Icbas.	Not knowing Qigong at all. In a not healthy condition volunteers.

Phase 1:

Recordings of Data were done during 3 week days, by appointment, and schedule starts from 9:30 am until 18:00 pm, in December 2014.

Demographic Characterization:

- 10 individuals of male genre
- 20 Individuals of female genre

All of them were 2nd year Medical students and they ages from 19 and 23 years old.

Randomization in Placebo and Experimental Amateur groups was done by the flipping a coin technique method.

Phase 2:

Recordings of Data were done during two weekends of Traditional Chinese Medicine Specialization Classes, in May and July 2015, schedule as following:

Fridays – from 18:00 pm until 22:00 pm.

Saturdays – from 9:00 am until 20:00 pm

Sundays – from 9:00 am until 14:00 pm

Demographic Characterization:

- 8 individuals of male genre
- 17 Individuals of female genre

They were Traditional Chinese Medicine post-graduation students or practitioners and they ages from 23 and 40 years old.

9.2 Parameters

We have recorded reaction time, during two segments - S1 and S2 - as an implicit method to measure Auditory Attention in the experimental conditions hypothesized.

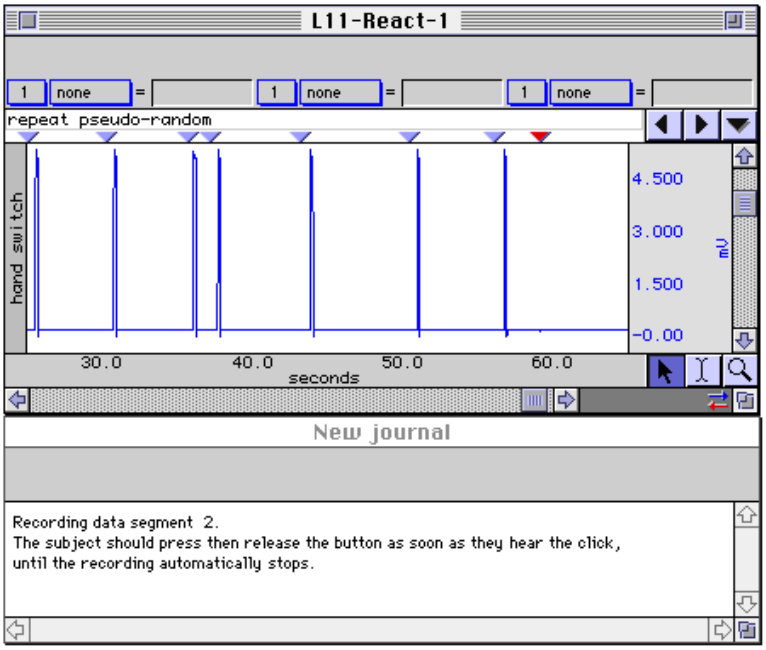
	Segments Characterization		**Experimental Conditions according to Psychology of Attention Theorization**	
S1	➢ Randomized interval of sounds sequence ➢ Auditory stimulation	→	Focused Auditory Attention	**C1**
S2	➢ Randomized interval of sounds sequence ➢ Auditory + Visual Stimulation	→	Divided attention of cross-modality task difficulty type (parallel processing)	**C2**

9.3 Instruments

Equipment used to collect and record response time was the Biopac MP Systems for research, hardware and software.

From its hardware we used: the data acquisition MP36R, its headphones and its pushbutton hand switch.

And from its software we had worked with BSL 4, lesson 11, reaction time recording of auditory stimuli. The software was programed to read the Reaction Time in seconds. Accordingly, all the following tables and results will use the same measure unit.



9.4 Procedures

The procedure was identical for the both groups: control and experimental. There were 2 sequences of 10 auditory stimuli per segment with diverse experimental conditions to be tested. Accordingly, instructions followed by students were:

Segment 1 [S1] - prepared to listen to a randomized interval of sounds sequence, individuals were asked to put and adjust comfortably the headphones, then to close their eyes and press the biopac pushbutton hand switch, as soon as they heard each auditory stimulus.

Segment 2 [S2] - still with randomized cadency, they continue with the headphones on, but here we asked them to open their eyes and besides the first task (pressing the hand

switch every time they heard the sound) they will have a simultaneous second stimulus; a visual distraction. They had to follow some led lights movements with their other hand.

Note: Biopac hand switch was calibrated individually at the beginning of each student record data.

Immediately after this baseline data record, each individual, accordingly to the Group, does the real or the placebo Qigong guided training during 5 minutes. At the end of that practice they were, again, subject to stimulation according the 2 segments (S) described above.

Results at the Baseline are called TO (Time zero) and recordings after Qigong Training or Placebo activity was named T1 (Time one).

Below we present a table summarizing the most relevant Psychological Attention Theories tested in each experimental segment.

Classical Psychological Theories about Attention	S1	S2
Divided attention of cross-modal task difficulty type		**x**
Parallel Processing		**x**
Focused Auditory Attention	**x**	

- **First Data Collection**

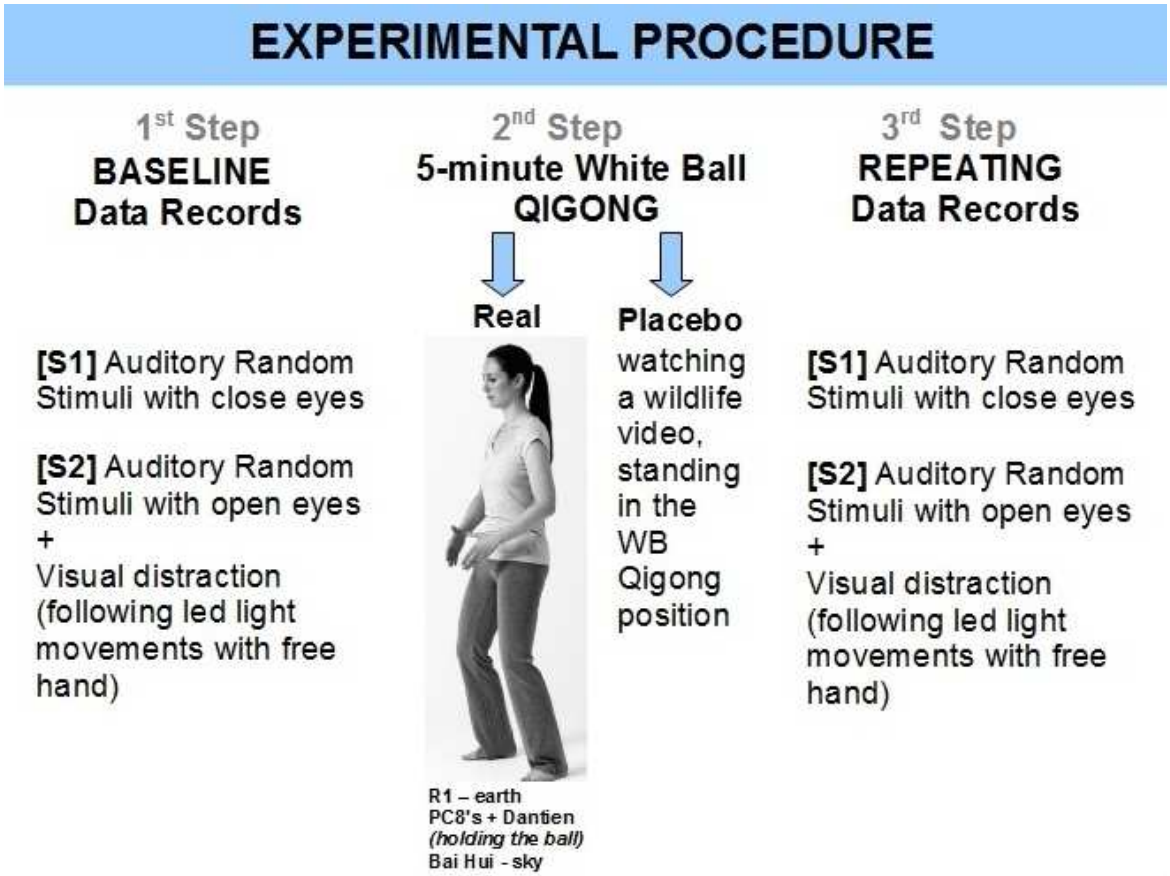
We started by recruiting 30 Medicine students totally naïve to Qigong practice and theory, and randomized them, by the flip-coin method, in 2 groups – experimental amateur and placebo. All the students were blinded to the technique and both groups believe they were doing a true Qigong movement. No preview explanation was given about definition, concepts, theory or indications to the practice of Qigong. Individuals were just informed that the study is about Attention and they will be asked to do a guided 5-minute Qigong. Those who asked us what Qigong is, was answered that it is a technique from Chinese Medicine, without any further explanation.

The ***experimental amateur group*** has done the **real Qigong standing position**, followed by short but clearly verbal instructions of the white ball movement with imagination of holding the ball between their hands (Pc8 acupoints activation) and cleaning/whitening its energy, each time they breath. A localization of basic acupoints (R1, Pc8 and Rg20) was referred by verbal indication while doing the exercise. ***Placebo group*** saw a video of wildlife animals during 5 minutes doing the same orthostatic position of the

Qigong standing and, with the arms positioned in an arching fashion (similar to the "holding the ball" movement).

- **Second Data Collection**

We recruited 25 students more but, at this time, an inclusion criterion was having some previous experience with Qigong practice (more than 8 months of training) and knew it theory and concepts. So, we created a ***professional experimental group*** of Traditional Chinese Medicine students. With them, we have made the same protocol of the amateur experimental group recruited for the first collection.



CHAPTER IV

Results

10. Results

The following Statistics Analysis was done.

- Arithmetic Mean
- Standard Deviation
- P value
-

A) <u>Direct Comparison between Control and Experimental Groups</u>

First Step – verify individual differences

Segment 1 (Non Parametric P < 0,001 – Mann-Whitney Test)

P < 0,001

Segment 2 (Parametric P = 0,200 – T Test independent samples)

P < 0,001

Results shown that the two groups were already at the beginning (even before the Qigong training) statistically very different. Therefore we cannot analyze the final differences between groups.

B) <u>Differences within the Group (before Vs after the Qigong)</u>

First Step – Normality – Kolmogorov-Smirnov Test

<u>Control Group:</u>

S1 T0/S1 T1 – P value = 0,200 (T – Test paired samples)

S2 T0/S2 T1 – P value = 0,200 (T – Test paired samples)

<u>Experimental Group:</u>

S1 T0/S1 T1 – P value = 0,011 (Wilcoxon Test)

S2 T0/S2 T1 – P value = 0,200 (T – Test paired samples)

Second Step – Differences before vs. after Qigong

<u>Control Group:</u>

S1 T0/S1 T1 – P value = 0,916

S2 T0/S2 T1 – P value = 0,884

Experimental Group:

S1 T0/S1 T1 – *P value = 0,006*

S2 T0/S2 T1 – *P value = 0,003*

Legend:

S1 T0 = Segment 1 (just auditory stimuli) with Results at the Baseline called TO (Time zero)

S1 T1 = Segment 1 (just auditory stimuli) with Results after Qigong Training or Placebo activity was named T1 (Time one)

S2 T0 = Segment 2 (auditory stimuli + visual distraction task) with Results at the Baseline called TO (Time zero)

S2 T1 = Segment 2 (auditory stimuli + visual distraction task) after Qigong Training or Placebo activity was named T1 (Time one)

Statistically very significant differences were found, on the experimental group, after the five minutes Qigong exercise.

Below we present a resume table with Averages, Standard Deviations and P Values for both groups on the two experimental conditions.

		Rand_1_T0	Rand_1_T1	Dif	Rand_2_T0	Rand_2_T1	Dif
Control Group	Average	0,2148	0,2153	0,0005	0,2957	0,2969	0,0012
	Standard Deviation	0,0287	0,0288	%	0,0573	0,0575	%
		P = 0,916		0,22	P = 0,884		0,41
		Rand_1_T0	Rand_1_T1	Dif	Rand_2_T0	Rand_2_T1	Dif
Experimental Group	Average	0,3152	0,2835	-0,0317	0,3871	0,3417	-0,0454
	Standard Deviation	0,1128	0,0890	%	0,1021	0,0939	%
		P = 0,006		-10,06	P = 0,003		-11,74

- **First Data Records**

As we already pointed, Qigong did not affect reaction time of the amateur experimental group in any congruent direction. Average results shown that RT after the Qigong is almost the same, being in fact, not even a millisecond difference.

We assumed that previous knowledge about the technique and its main characteristics was crucial to obtain improvement due to the *conditioning* effect. However, a qualitative study about *"The Psychology of Qigong"*, in 2010, analyzed Qigong experienced practitioner's sensations, perceived benefits, expectations, challenges and other issues. The author Paul Posadzky, found a very common outflow from practitioners about the difference they felt when they have automatic memory about the movements (because it is an often practiced one) comparing to the challenging situation whereas they are learning a new movement. He concluded that "overall, familiarity with the Qigong

movements seems to help individuals reduce performance uncertainty and distraction, and allows them to focus their minds on their present experience of Qigong, enabling them to explore its depth in greater detail".[37]

It could have happened, also, that the Amateur Experimental Group couldn't focus on the exercise itself, during those 5 minutes, because it was completely new to them. It was, in fact, the first time they have done the movement despite its simplicity, it was absolutely a novelty to those individuals, and so they might be wondering about learning the correct position instead of letting their mind and conduits (meridians) flow freely.

- **Second Data Records**

It is notorious the fact that while placebo and experimental amateur groups responses time were totally incongruent, sometimes faster and most of others slower, with no consistent effect, the professional experimental group was very consistent with their reaction time getting faster in both experimental conditions/auditory segments.
It suggests the importance of the *conditioning* effect.
Furthermore, it is very interesting that in the experimental condition *Rand_2* the enhancement effect was even greater when comparing to *Rand_1* condition. As it is the auditory stimuli combined with the visual distraction. According to the Psychological Theories of Attention, we might interpret that Qigong augment the brain limits capacity reducing the sensory cross-modality interference effect.
That enhancement of reaction time, in the professional experimental group, with very significant statistically values, led us to the validation of our two hypotheses for the Professional Experimental Group, accordingly:

- **Hypothesis 1** – Five-minute WB Qigong movement shortens the RT, indicating an improvement effect over focused auditory attention

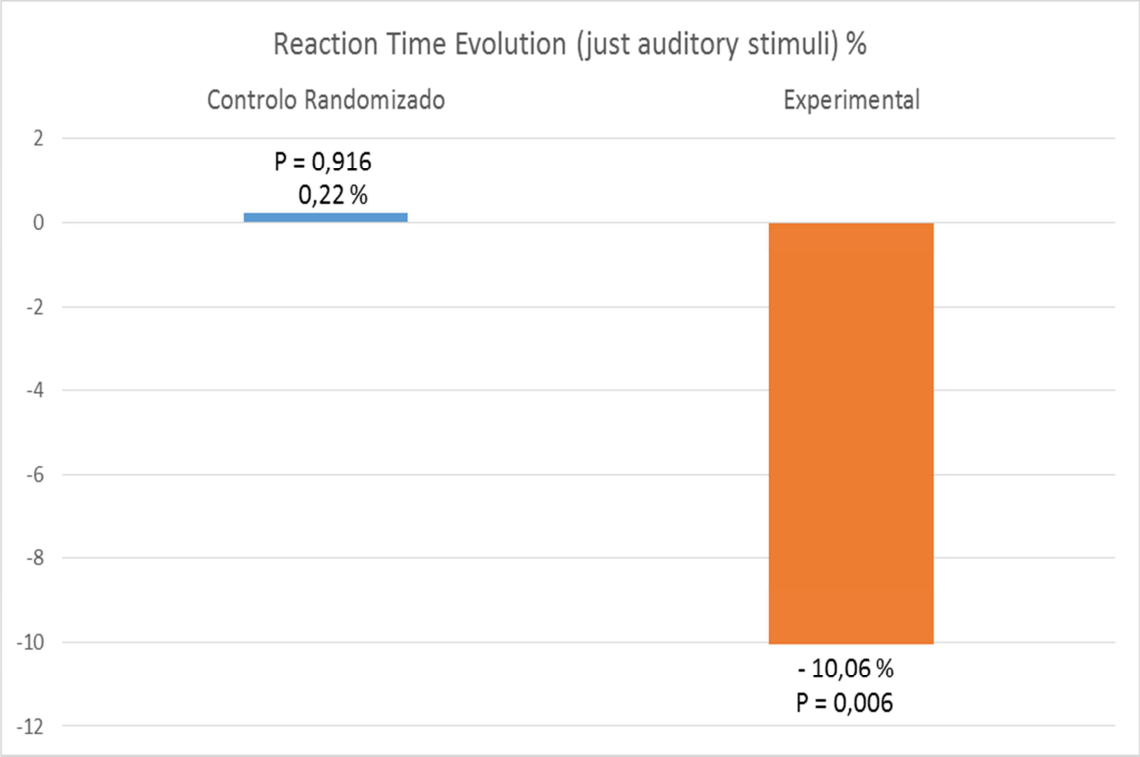
Validated with a P value of 0.006

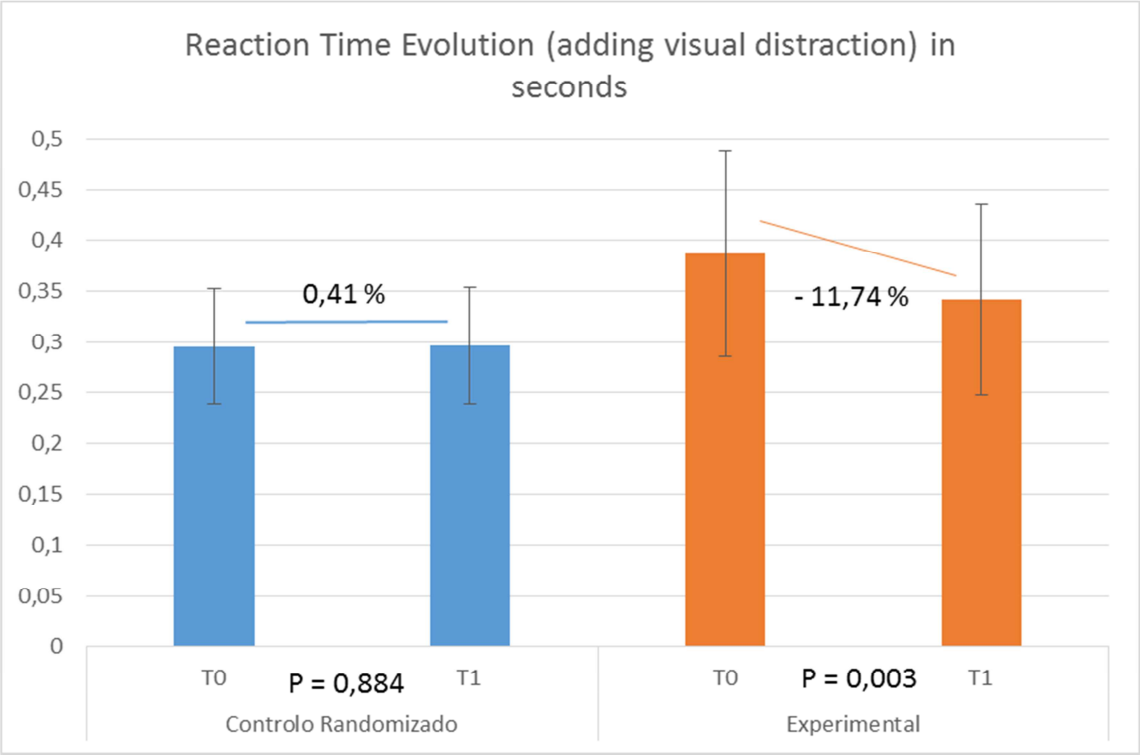
- **Hypothesis 2** – Five-minute WB Qigong movement shortens the RT, indicating an improvement effect over auditory divided attention of cross-modal difficulty type design

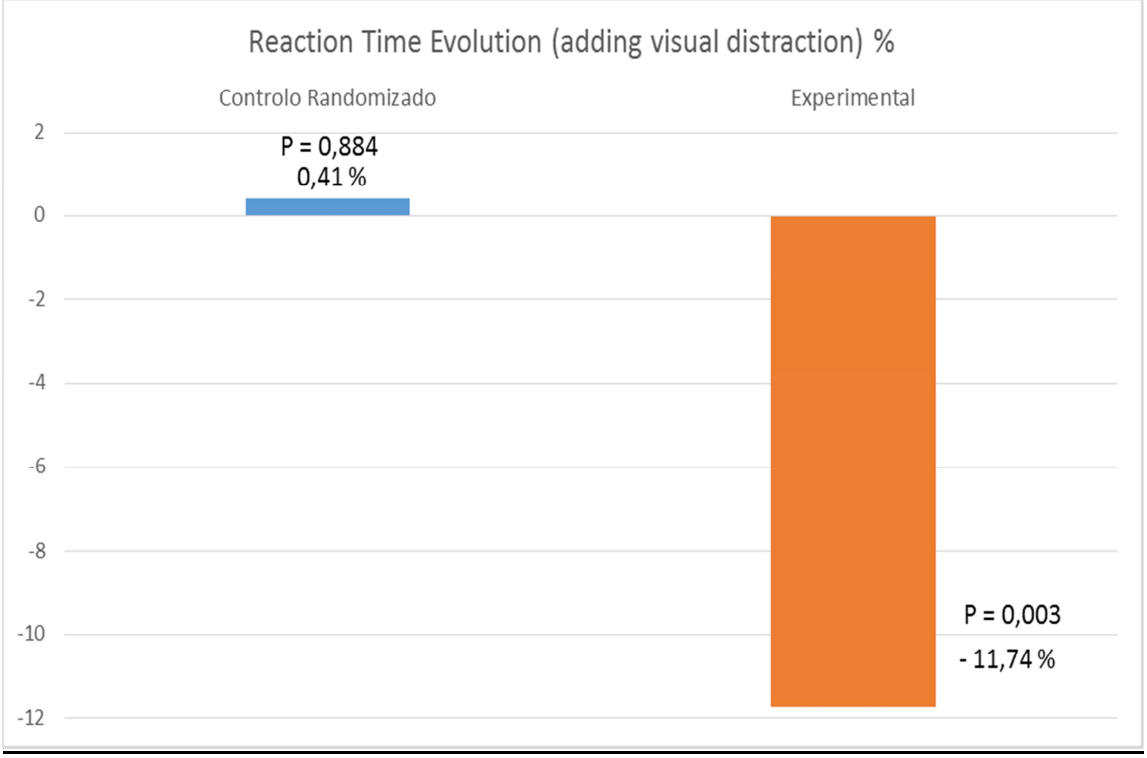
Validated with a P value of 0.003

Those results suggest the importance of knowing pretty well the Qigong technique together with its movements, principles and mechanisms of actuation. Being familiar with the exercise and allow the mind to focus and let the body relax to enter in the "mind-in-body" state seems to produce a positive and congruent effect as it was maintained in all

the experimental conditions and have had its “peak performance” averages difference on the most challenging one; the segment 2.







Legend:

Placebo Randomized Group

Experimental Group

Looking for the graphics, we observe that while in the placebo randomized group individual's reaction time almost didn't change, in the experimental, reaction time decrease significantly showing performance enhancement in both segments.

Another interesting aspect occurred while analyzing differences, within the Experimental Group, between average times for each segment, before and after the Qigong. The "peak" average performance was obtained during randomized segment number 2 *(Rand_2_T1)*, the one with visual distraction added and randomized intervals of sounds input.

According to Psychological main Theories of Attention, this experimental segment has the most challenging brain processing conditions; it was designed to test parallel processing with divided attention of cross-modality (auditory and visual stimuli) type. Results indicate that Qigong has positively enlarged the processing capacity, minimizing it baseline limitations.

This effect is in-line with several recent studies that suggest MECPs has enhancing cognitive performance in multi-tasking challenges. [40/41/42]

Present Results and General Psychological Considerations

- **About Divided Attention and Parallel Processing;**

  In Experimental Condition 2, where we add the visual distraction to the main task, results obtained on the two groups proved the Classical assumptions from Cognitive Psychology about Divided Attention. Being in congruence with Pashler words in his book "The Psychology of Attention": "The identification of more than one stimulus is said to be subject to capacity limitations if the speed or efficiency of the processing is reduced when other stimuli are processed at the same time, compared with the case when only one stimulus is processed at a time."

- **About Processing Limitation;**

  In the Professional Experimental Group the "peak" improvement of average reaction time occurred during the segment with visual distraction processed at the same time of the main auditory task. This suggests that Qigong training produced an immediate effect over performance enhancement; improving their limits of processing capacity. [4]

CHAPTER V

Discussion

11. Discussion

Previous studies, tested the efficacy of the White Ball Qigong over diverse cognitive and stress management mechanisms such as Anxiety reducing (Sousa,C.,2011, Oliveira,R.,2014) Visual Attention,(Duarte, L., 2013) and Burnout symptoms reducing (Seiça, A.,2013).

Sousa, C., 2011, obtained anxiety reduction on music students, with ages between 10-12 years old during their musical actuations on stage.

Leonel Duarte, 2013 studied the effect of the WBQ movement over Attention, measured by the visual psychometric scale D2 in a scholar population of adolescents with ages between 12 and 14 years old.

Seiça, A., 2013, tested the effect of WBQ on Burnout Symptoms, such as; emotional exhaustion and depersonalization, in Nurses. They obtained significant improvements.

Oliveira, R., 2014, found that the WBQ regular training decreases significantly anxiety and made the vegetative functions become more stable.

All of them obtained positive effects and performance improvements as a result of a Qigong regular training and education. They mostly have done 8 sessions of WBQ guided training (lessons) with the individuals plus a prescribed 5 minutes twice a day at home on a daily basis during a month.

Our study aimed to verify if that positive effect happens also with a single isolated practice of the White Ball Qigong or if a minimum training is, in fact, needed to obtain the effects.

Our results confirm that Qigong effects are subject to ***Conditioning***. A regular training creates a brain and a somatosensory system *pattern*.

This *pattern* becomes easily recognized in future practices leading to the immediate activation of the ***Qi*** sensation.

First Data Records:

Due to a lack of training of the individuals (naïve to Qigong) a lack of positive conditioning effect occurs.

Second Data Records:

Individuals have a deeper education and training in Qigong which leads to a positive conditioning effect.

12. Limitations and further Improvements

Considering that our sample was collected at ICBAS, University of Oporto, with the inclusion criteria of having between 20 and 35 years old and the actual universe is of 10000 registered individuals, in order to obtain statistical relevance the ideal sample number would be N = 370.

As this study was not financially supported by any organization it was impossible due to economic and time limitation reasons to obtain such amplitude.

The present study had had some constraints specially related by time and material availability. As it was just a 9 months study and we have to count with volunteers to the three samples, it was not possible to use all the laboratory measurements we would like to test. So we will be happy to give here our suggestions for improvement for further investigations:

A. For the best of scientifically results, we would like to alert for the importance of replicate the present study design in a larger sample and, for a better data generalization; it would be fantastic if possible done in a different country.
B. For experimental amateur, test the effect with regular practice; 2 times daily during 4 weeks and then, collect reaction time again, after 3 months of daily practice.
C. Use thermography room to make sure that individuals are really focused on the Qigong exercise. According to Luís Matos study, done in 2011, when we are really into the exercise and thinking about the acupoints and breathing, those regions increase blood irrigation significantly, producing a measurable heating effect.
D. As the main treasure of TCM is the individualization of each Diagnostic according to each patient sensations, findings and vegetative signs,[46] it would be interesting to sample two groups according to Tongue Diagnostic signs of Repletion versus Depletion. And then analyze the outputs of those two groups after the Qigong. Our guess, consolidated by the three case-studies discussed above, is that the investigator should find performance improvement in both groups as Qigong is known by its homeostatic balance effect.
E. It is our subjective perception that individuals were significantly better following the visual distraction light trajectory, with one of their hands, after the Qigong training. To test that, further studies may record the number and amplitude of hits with a Posturography device and software at the baseline procedure and after Qigong training. Testing the Hypothesis that Qigong enhance the capacity of decoupling selection in two modalities of sensory input: in the visual task as well, as well as the auditory stimulation one.
F. Use JAMF Attention Modelling Software to test Qigong effects. [47]

G. Test the effect of Qigong on RT with a Task similarity input (two auditory stimuli at the same time). As according to Treisman and Davies (1973) findings “two monitoring tasks interfered with each much more when the stimuli on both tasks were in the same sense modality than when they were in different modalities”.

While conceptualizing Attention, classical cognitive researchers questioned about the existence of one central attentional system or multi-modal ones limited by each sense modality particularities. With modern technology availability, further investigations might like our suggestion to use some of them; EEG, event-related brain potentials (ERP’S) and Magnetic Resonance (brain scan), for instance, and monitoring which brain areas are activated in segments 1 and 3 task (focused auditory attention, individuals with close eyes) comparing to zones activation with experimental segments 2 and 4 (visual and auditory tasks simultaneously). As the present results proved statistically very significant P values on both experimental conditions and a “peak” performance improvement of reaction time obtained at condition 2 (with visual distraction added), we would like to see further tests with this type of neurophysiology monitoring to answer the following hypotheses:

H1: Qigong training improvement acute effect on perceptual auditory attention, with simultaneously visual distraction stimulation, are better explained by an augment of capacity limitations of a unique brain area activation suggesting it main influence over an attention system supra-model.

H2: Qigong training improvement acute effect on perceptual auditory attention, with simultaneously visual distraction stimulation, are better explained by an augment of capacity limitations of various brain areas activation suggesting it main influence over a multi-modal modality attention system subjected to each sensory sub-systems.

Physiological differences between men and women are largely documented and we were aware of that existence, as well as age differences might have a role. By sample size limitations we were not able to divide groups accordingly gender. However, while making the groups randomization, we have done our best to balance the groups with as much masculine as feminine individuals.

According to TCM, in general, men are considered yang and women yin. This is believed to influence Qi direction vector, as yang qi goes upwards and yin Qi goes downwards. Therefore, our suggestion for further investigations with larger samples is to design two different experimental conditions to test eventual results depending on gender sampling.

For instance, further investigators might found interest in test the Attention response time to an emotional words listening task and compare it with RT for other task using project-

oriented related words. It would be valuable to monitor, simultaneously, brain activation areas.

13. Conclusion

For the best of our knowledge and, according to the Literature Review, this was the first experimental study about Qigong effect on Auditory Attention. Earlier studies proved the efficacy of Qigong on Visual Attention; Duarte, L., 2013.[6] It will be interesting for further investigations, to test and measure Qigong effect on both sensorial modalities, in a dual task methodology.

It is important to remember that, as better reviewed on Chapter I, Attention is one of the most complex neurocognitive mechanism of the Human Mind. The present results indicate an immediate improvement on individual's cognitive performance after single 5-minute WB Qigong training, when practiced by the professional experimental group; individuals subject to the *conditioning* effect of this practice. In our modest opinion, it is worthwhile to further investigation with larger samples and with other measurement equipment.

Once again, results obtained during the experiments for the present study are congruent with several brain mechanism assumptions from Cognitive and Neuro Psychology. This indicates that our study design and experimental control conditions were well conducted. Therefore, our results of a statistical very significant improvement of P value of 0.006 for H1 and P value of 0.003 for H2 over individual's performance response under the circumstance of a 5m training of Qigong, when done by the professional group, are very encouraging. .

These preliminary results, if possible to be confirmed by future studies, have potential benefits not only to the scientific community but especially to the society.

Our wish, by warranting further in-depth investigations about this theme, would be to possible achieve Governmental Organizations interest in analyzing that valuable scientific data and from that may, desirable, take action measures like implementing Qigong training (allowing ordinary people to benefit from all its health related benefits) in community backgrounds such as;

- ➢ Kindergartens
- ➢ Schools
- ➢ Health Centers
- ➢ Daycare Centers (both for Children and Elderly population)

➢ Work places

We are totally aware of the long interval of time that may occur between our here assumed wish and the first steps of its materialization, nevertheless while writing the present Master Thesis work we read, somewhere in a poster placed in the University of Psychology Library that *"the only impossible journey is the one we haven't started yet!"*

We could not agree more with that assumption. Several research have been done in the last twenty years for the benefits of Qigong and the present work humbly aimed to give, at least, some inspiration for further research.

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Webgraphy:

W1 Shambhala Centres Daoist Qigong [online] http://www.daoist-qigong.org/ [found at 17.09.2015]

W2 Simply Psychology [online] http://www.simplypsychology.org/Systematic-Desensitisation.html [found at 30.09.2015]

W3 Sophrology center online [online] http://www.sophrologycenteronline.com/about-sophrology/what-is-sophrology/ [found at 30.09.2015]

Attachment 1

“White Ball Qigong movement” Instructions

Attachment 2

Data Results Tables

Attachment 3

Written Informed Consent

Attachment 4

Etical Comité Vote