The Biologic Effects of the Interventions of Heart-Generated Coherence and Focused Intention on Distilled Water Using Plant Growth as an Objective Measure

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Dedicated to my parents and greatest supporters, Allan and Edith Chappell

Sadly missed but always in my heart

The work reported in this thesis is original and carried out by me solely, except for the acknowledged direction and assistance gratefully received from colleagues and mentors.

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Jane Simmons

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To be yourself in a world that is constantly trying to make you something else is the greatest accomplishment. Ralph Waldo Emerson

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ABSTRACT

The Biologic Effects of the Interventions of Heart-Generated Coherence and Focused Intention on Distilled Water Using Plant Growth as an Objective Measure

This study examines and compares, against a control, the biologic effects of two interrelated interventions using plant growth as an objective measure. Both interventions involved the participation of the same eight Heart-Generated Coherence (HGC) practitioners utilizing the HeartMath® technique of Heart Lock-In for the purpose of creating heart-generated coherence. Both interventions used distilled water to hydrate wheat seeds as they grew into plants over a 16-day growth period. In the first intervention, containers of distilled water were placed out of sight within 37 inches of the HGC practitioners, without their knowledge, while they practiced the above HeartMath® technique. This water was used to hydrate 54 wheat seeds in Plant Group A (PG-A) during the 16-day growth period. In the second intervention, containers of distilled water were placed in sight within 37 inches of the same eight HGC practitioners who practiced the HeartMath® technique while also focusing on a specific written intention directed toward the water for healthy plant growth. This water was used to hydrate 54 wheat seeds in Plant Group B (PG-B) during the 16-day growth period. A control group of 54 wheat seeds in Plant Group C (PG-C) were hydrated with distilled water not exposed to any intervention and grown for 16 days. There were no statistically significant differences found in pre-test and post-test weight or post-test length between the intervention groups and control group. However, there were additional interesting statistically significant findings from this study. Conclusions and possible implications related to future research are discussed.

Key words: Coherence, energy field, HeartMath®, intention, water.

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CHAPTER 1:
INTRODUCTION

Truth is camouflaged by its simplicity. Harry Palmer

Background

Background and Theoretical Framework: This study examined the biologic effects of the interventions of heart-generated coherence and focused intention on distilled water using plant growth as an objective measure.

Webster defines the word coherence as "logical interconnection." Quantum science is now revealing the extent to which this logical interconnection truly exists. Heisenberg's uncertainty principle tells us that quantum particles are constantly fluctuating, giving rise to the Zero Point Field. This continuous interaction creates potential entanglement through quantum waves and "implies that all matter in the universe is connected on the subatomic level through a constant dance of quantum energy exchange."[1] How might this dance be evident in the interactions between the power of human intention, the electromagnetic field of the heart and the growth of plants? This research project was designed to study the effects of both positive intention and coherence generated by the human heart on water utilized in the growth of plants.

Statement of the Problem

The intention of this study was to further the understanding of heart-generated coherence by examining its effects on water, using plant growth as a marker. Much research has been done as to the effects of heart-generated coherence. In addition, many

studies have been written, assessing the power of intention in affecting human and non-human subjects. (See Review of Literature, Chapter 2) This study undertook an examination of the results of combining both heart-generated coherence and the power of intention.

The Principal Investigator (PI) compared the effects of two separate interventions with the same eight Heart-Generated Coherence (HGC) practitioners using HGC, both with and without positive intention, against a control group on water used to hydrate hydroponically grown plants. By measuring plant growth for all three groups, the PI intended to demonstrate differences in plant growth as an indicator of the effect of heart-generated coherence and answer the questions:

1. What happens to the growth of plants when water used for their growth has been in close proximity to human heart-generated coherence?

2. Is the effect changed in any way when adding intention to the protocol?

The directional hypotheses were:

1. Heart-Generated Coherence (HGC) has a positive effect on water used to hydrate wheat seeds, resulting in the increased growth rate of wheat plants, as measured by plant weight and length.

2. Intention added to HGC has a positive effect on water used to hydrate wheat seeds, resulting in the increased growth rate of wheat plants, as measured by plant weight and length.

The null hypotheses were:

1. HGC has no effect on water used to hydrate wheat seeds, resulting in no increased growth rate of wheat plants.

2. Intention added to HGC has no effect on water used to hydrate wheat seeds, resulting in no increased growth rate of wheat plants.

Scope of Study

Within the scope of this study two interventions were used.

Intervention #1 consisted of the practice of Heart-Generated Coherence (HGC) by eight HGC practitioners in proximity of distilled water. The water was utilized to hydrate wheat seeds grown hydroponically.

Intervention #2 consisted of the practice of creating HGC by the same eight HGC practitioners with directed positive intention added to the protocol in the proximity of distilled water. This distilled water was used to hydrate wheat seeds grown hydroponically.

During both intervention sessions, a Psyleron REG-1 Random Event Generator (REG) was outputting a sequence of random binary events in order to analyze the effects, if any, of deviation from random sequencing during the shared group coherence.

Relevance of Study to Field of Integrative and Energy Medicine

Holos University Graduate Seminary's mission statement reads,

> *Holos University Graduate Seminary prepares students to integrate Universal Principles of Spirituality and Holistic Health through self-development, scholarly exploration and research, and compassionate service.*[2]

Further elaboration of the mission reads,

> *The mystical traditions of virtually all religions contain substantial references that address the subtle physical energies of the body, the transpersonal aspects of the mind, and the expressive activity of the spirit. These traditions exist at the very core of holistic mysticism, spiritual direction, counseling intuition, transformational psychology, and integrative healthcare.*[3]

As noted above in the Holos University Graduate Seminary mission statement and introduction, the areas of study at Holos University integrate physical, mental and spiritual aspects of healing. Studies at Holos University focus on approaches described within the fields of Complementary and Alternative Medicine (CAM), Energy Medicine and Integrative Healthcare. To describe the integrated blend of these modalities, the Principal Investigator of this study will use the term, "Integrative and Energetic Healthcare" (IEH).

IEH is a blend of CAM, combined with conventional Western medicine when appropriate, encompassing healing modalities that address the whole person: body, mind, emotion and spirit. "Energy Medicine uses the flow of energy in the body as a medium for healing, based on Biophysics, whereas conventional medicine is based primarily in

Biochemistry using pharmaceuticals."[4] This flow of subtle energy is known by different names in various traditions and cultures, such as chi, ki, prana, orgone or etheric energy. This research is studying the possible effects of electromagnetic energy generated by the human heart.

The National Center for Complementary and Alternative Medicine (NCCAM) defines CAM as "a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medicine."[5] With an emphasis on natural and non-invasive treatment, the unified approach of IEH embraces traditional and alternative modalities contributing to physical, mental, emotional and spiritual wellbeing.

The use of alternative forms of health care is rising and becoming more widespread. Researcher Michael McQuade reports a rapid increase in the popular use of CAM, estimating an increase from $14 billion to $21 billion spent on alternative health care between 1990 and 1997. He concludes, "There can be no doubt that alternative medicine is playing to a broader audience than at any time since it was pushed to the margins of respectable medicine in the early 20th century."[6]

As a multi-disciplinary approach, IEH includes treatments as diverse as homeopathy, hands on healing, acupuncture, biofeedback, hypnotherapy, massage, nutritional therapy, psychological and spiritual counseling. While far from complete, this list is representative of the kinds of holistic therapies that make up IEH. The Glossary of Natural Healthcare terms lists over 100 topics.[7]

In contrast to medical specializing, IEH is widely extensive, as it holistically encompasses a diversity of healing arts that, when used in concert, take into account all

facets of health on physical, mental, emotional, energetic and spiritual levels. This diversified holistic approach, in contrast to a single treatment model, widens the potential for healing as it "combines the discipline of modern science with the wisdom of ancient healing."[8]

This research study examined the effects of two interventions on water: heart-generated coherence (HGC) in Plant Group A (PG-A), and directed positive intention combined with HGC in Plant Group B (PG-B). Considering the critical role that the heart serves in sustaining human life, the energetic and physiological effects of heart-generated coherence fit into the holistic framework of IEH. Further reasons that this study has relevance to the field of IEH include:

- Directed positive intention utilized in the study has previously been shown to demonstrate healing effects in plant, animal and human studies[9]
- Since the body, including the brain, is made up of 70-90% water, potential positive effects of HGC on water could have far-reaching implications regarding the mental and physical wellbeing of the mind and body.
- HeartMath® techniques utilized in the intervention, in order to produce HGC, have been previously found to positively impact body, mind, emotion and spirit as they assist to:

    - Overcome the physiological effects of stress on the body[10]
    - Manage psychological effects of stress[11]
    - Receive and respond to intuitive information[12]

- Affect the magnetic energy field surrounding the body[13]
- Promote peace and clarity of thought[14]
- Reduce anxiety[15]
- Influence DNA[16]
- Enhance immunity and healing[17]

The HeartMath® techniques shown to positively affect physical, mental, emotional health and wellbeing are readily available to everyone by using the breath, the heart and a feeling of appreciation. Utilization of these tools has wide-ranging potential for self-healing, as the techniques are simple, effective, and easy to learn. They have been successfully used by people of all ages in many different walks of life, including children, high school students, athletes and people in high stress employment.

The preceding studies cited demonstrate the far ranging implications of HGC for human health as well as plants, animals and water. Taken to a global level, Integrated Healthcare can be extended to include our planet. Integrative and Energetic Healthcare becomes truly integrated as it extends outward to include all forms of life.

Definition of Terms

Coherence: In this study, coherence refers to resonance, synchronization and entrainment, emerging from the harmonious effects of sustained positive emotions generated by the heart.

Em-Wave PC® Heart Rhythm Monitor Feedback System: An interactive hardware/software system that records beat-by-beat changes in heart rate using an electronic ear sensor, analyzing heart rhythm patterns.

HeartMath® Heart Lock-In Technique:

1. Shift attention to the heart
2. Breathe slowly and deeply
3. Activate a feeling of appreciation
4. Continue breathing into the heart and allow appreciation to radiate

Hydroponics: A method of plant growth without the use of soil, and in the case of this study, by immersing plant roots in a diluted nutrient solution.

Intention: Direct, remote mental influence; an act or instance of determining mentally upon some action or result; from the Latin "intenitus," meaning "a stretching toward."

Random Event Generator: An electronic device, which outputs a sequence of random binary events, obeying all expected laws of probability.

CHAPTER 2:
REVIEW OF LITERATURE

Definitions of Coherence

The term coherence, used in the realm of physics, refers to "two or more waves that are phase- or frequency-locked together to produce a constructive waveform."[18] A laser beam is illustrative of this type of coherence. It is phase-locked to create a powerful coherent energy wave; in comparison, an incandescent light bulb emits diffused energy waves.

Mathematically speaking, coherence describes an ordered distribution of power within a waveform, as demonstrated in a sine wave, a frequency repeated over equal intervals of time. These resonant waves appear in the rhythms of the ocean and the reverberation of a tuning fork, as well as in auditory and electrical engineering fields.

Physiological coherence is defined as, "…a state in which two or more of the body's oscillatory systems, such as respiration and heart rhythm patterns, become synchronous and operate at the same frequency."[19] In this study, coherence refers to resonance, synchronization and entrainment, emerging from the harmonious effects of sustained positive emotions generated by the heart.

Rollin McCraty, Mike Atkinson and Ray Bradley define physiologic correlates of coherence as, "increased synchronization between the two branches of the autonomic nervous system, a shift in autonomic balance toward increased parasympathetic activity, increased heart-brain synchronization, increased vascular resonance, and entrainment between diverse physiologic oscillatory systems."[20]

The benefits of coherence in the body include a system-wide energy increase along with improved cognitive, mental and emotional ability. Viewing the difference between a laser beam and the suffused photons of a light bulb, it becomes evident that there is great strength and power in the linking of ordered magnetic energy. Sub-atomic coherent particles "stop behaving like anarchic individuals and begin operating like one well-rehearsed marching band."[21] This creates an effect known as "entrainment."

Entrainment

Entrainment is a phenomenon discovered by Dutch clockmaker Christian Huygens in 1665 as he witnessed pendulum clocks swinging in unison. It refers to increased coherence between systems demonstrated when flocks of birds or schools of fish suddenly move together as one or fireflies flash simultaneously, through a resonance of rhythmic vibration. Physiologically speaking, this state is created when two or more of the body's systems become synchronous, enhancing energy and efficiency in functioning.

Entrainment can occur both internally and externally, within the body systems as well as shared harmonically with others. Limbic resonance creates a state of communal connection that supports internal exchange and adaptation between people. Science is now discovering how the entrained state of coherent, hormonal communion between mother and baby assists in the stabilizing of the mammalian nervous system.[22]

Indigenous cultures have long utilized the benefits of entrainment created through drumming. Neurologist Barry Bittman investigated the effects of group drumming on the alteration of stress-related hormones. His study measured positive effects in DHEA hormonal changes and other neuro-immunal responses.[23]

Certain types of music can also create entrainment in the body. Citing Mitchell Gaynor's book, *Sounds of Healing: A Physician Reveals the Therapeutic Power of Sound,* Holos University graduate, Dr. Debbie Pratt writes in her 2008 dissertation, "Entrainment occurs when the vibration of one object is projected upon a second object with a similar frequency, causing the second object to vibrate in resonance with the first…. Studies have shown that when instruments emit Extremely Low Frequency (ELF) sounds between four and eight cycles per second, they mirror the theta range of brain waves that occur during meditation, thus entraining the brain waves to these same frequencies."[24]

Similar coherent movement can be self-generated within the body. The heart, the body's largest oscillator, can pull the other systems into entrainment with its harmonious efficiency when feelings of love and appreciation are sustained. Entrainment can occur at physical, mental and emotional levels within the human biological system.

Role of the Heart

Paul Pearsall, in his book, *The Heart's Code*, gives a "cardio-energetic portrait" of the heart, including the following points. He writes that the heart:

- Is our most powerful organ, being the largest generator of electromagnetic energy in the body
- Responds directly to the environment both with and without the brain's awareness, such as when the heart contracts in the presence of an electromagnet
- Is a conductor of the energy of the cells of the body influencing cellular functioning

- Is a dynamic system expressing itself as energy, matter and information
- Is the body's primary organizing force connecting the brain and body
- Resonates with information-containing energy
- Is the body system's core as it pumps information from, to and within every cell of the body
- "Speaks" and sends information with its own unique wisdom
- Exchanges information with other hearts through info-energetic vibration

This tireless organ sends blood through thousands of miles of vessels of the body from beginning of physical life within the womb to the moment of death. The systolic and diastolic systems, along with the systemic/pulmonary rhythm, make human life on the planet possible. Heart cells have the ability to pulsate, communicating through a subtle energy biochemical exchange with one another.[25]

Studying the rate at which the heart beats can provide insights into the physiology and emotional state of the body as the heart's rhythmic patterns change. Heart Rate Variability (HRV) is a measure of neurocardiac function, gauging changes in heart rate as the heart speeds up and slows down, and is affected by thoughts and emotions. The study of HRV provides heart rhythm coherence feedback and "is a powerful, objective and noninvasive tool to explore the dynamic interactions between physiological, mental, emotional and behavioral processes."[26] A two-way system of communication between the heart and the brain helps to regulate heart rate, blood pressure and HRV.

Psychologists have found that monitoring HRV provides a map of the emotions as "thoughts, perceptions and emotional reactions are transmitted from the brain to the heart

via [the sympathetic and parasympathetic] branches of the autonomic nervous system and can be seen in the patterns of your heart rhythms."[27] An ordered HRV pattern indicates cardiovascular efficiency, reflecting autonomic nervous system dynamics. In this coherent state, the two branches of the nervous system move into a synchronous state, working together.

Sustained positive emotions appear to give rise to a state of psycho-physiological coherence indicated by a smoother coherent pattern. "The coherent mode is reflected by a smooth, sine wave-like pattern in the heart rhythms and a narrow-band, high-amplitude peak in the low frequency range of the heart rate variability power spectrum, at a frequency of about 0.1 Hz (Tiller et al., 1996)."[28] Negative emotions are associated with disordered, incoherent patterns in heart rhythms, as measured through spectral analysis.

In physiological terms, the sympathetic nervous system controls the "fight or flight" response during times of stress, with effects of sympathetic stimulation including dilation of the pupils, reduction in peristalsis, accelerated heart rate and blood pressure increase. The parasympathetic nervous system, on the other hand, gives the "rest and digest" response, which includes constriction of the pupils, decrease in heart rate and blood pressure. Measuring the HRV shows the balance (or imbalance) between these two systems, since one is used to slow the body down and the other to speed the body up.

Research Studies Using the Heart

How far reaching can the effects of coherence be? In a study of electroencephalogram (EEG) correlations between pairs of people, Dean Radin found that two people who were bonded (couples, parents and their children) displayed EEGs

that appeared to synchronize. This indicates an energetic exchange that takes place between couples and in many instances results in an entrainment of brain waves.[29]

The synchronization occurs not only in brain waves, but also in cardiac signals. In a recent study by Jeanne Denney, patients in a comatose state, nearing death, had significant changes in their heart rhythm patterns that coincided with the heart patterns of their caregivers. These findings suggest that energetic communication occurs between patients and those who care for them even when there is no longer any verbal exchange.[30] This biology of relationship is further illustrated in a responsiveness of cells in vitro to the electromagnetic field of the heart.[31]

In addition, in a study detecting and measuring cardiac energy exchange, researchers Rollin McCraty and William Tiller discovered evidence of an exchange of heart-generated electromagnetic energy as one person's electrocardiogram (ECG) signal registered in another's EEG.[32] The signal was strongest for people touching or in close proximity but was still detectable in people who were distanced from each other. When the subjects held hands, the "source's ECG could be clearly detected in the receiver's SAW [signal averaged waveform]."[33]

In a study where tumor cells and healthy cells were both exposed to a coherent ECG signal, the electromagnetic field seemed to have a cellular-specific effect. Growth of the healthy cells was increased by 20%, while growth of the tumor cells was inhibited by the same margin. This research has intriguing implications for possible future therapeutic treatment aimed at restoring and stabilizing cancerous cells.[34]

Emotional and Physiological Effects of Stress

In the Western lifestyle, the prevalence of stress seems to be an accepted part of life and yet the effects are extremely debilitating. Researcher Hans Selye defined stress as "the non-specific response of the body to any demand for change."[35] The fight or flight reactions to those things over which we have little or no control, cause what Selye termed "The Alarm Reaction."[36]

The reaction to stress in the body is a release of adrenaline into the bloodstream, which elevates heart rate, blood pressure, tenses muscles and speeds breathing. In short, it prepares us for fight or flight. Other hormones such as noradrenaline and cortisol (known as the stress hormone) are also released. When stress becomes a chronic state, it can be extremely damaging to the system.[37] According to the studies reported in the book *The HeartMath Solution,*[38] chronic high levels of stress can cause physiological damage leading to heart disease. When the nervous system is out of balance, blood vessels constrict, there is a rise in blood pressure and energy is wasted. If this becomes a chronic state, hypertension may result.

The body's stress response encompasses over fourteen hundred physical and chemical reactions, as well as over thirty hormones and neurotransmitters.[39] A Duke University study showed that stress could affect blood supply to the heart. As well, chronically elevated levels of adrenaline and cortisol can affect immune function, causing bone and muscle density, impaired memory and increased fat accumulation.[40] Incoherence in the body affects brain centers that are involved in perception and emotional processing, impacting mental acuity.

Effects of Positive Emotions

It is the function of love to unite all things unto itself and to hold all things together by extending its wholeness. A Course in Miracles

How does positive emotion affect physical, mental and emotional wellbeing of the body? Institute of HeartMath® "research shows that the …process of focusing attention in the area of the heart while experiencing a positive feeling, changes the patterns of information flowing along this pathway [from heart to brain] to a more coherent and harmonious pattern."[41] By focusing on the heart and allowing feelings of love and appreciation to expand and radiate outward, our systems come into alignment and a coherent state is created in the body. This can produce a feeling of "amplified peace."[42]

Positive emotions increase production of the hormone DHEA. This hormone has been called the 'anti-aging hormone' since it seems to decrease with age. Low levels of DHEA have been found to be a factor in many medical problems, such as sleep disorders, diabetes, chronic fatigue, high cholesterol and depression. When the DHEA levels are high, cortisol levels lower, causing feelings of revitalization. In one study, participants lowered cortisol levels by 23% and increased DHEA by 100% through feelings of love and appreciation.[43]

In related research, subjects were monitored through feelings of both anger and compassion and tested on the effect to the immune system. While the experience of anger inhibited their levels of the immune antibody, secretory Ig-A (S-IgA), subjects were able to significantly increase their levels of S-IgA following a five-minute experience of positive emotion.[44] It appears that feeling good is, in fact, good for you.

Magnetic Field of the Heart

I believe that there is a subtle magnetism in Nature, which if we unconsciously yield to it, will direct us aright. Henry David Thoreau

Ampere's Law states that electric currents produce magnetic fields. The magnetic field is created when an electric current runs through a conductor. In 1963, G. Baule and R. McFee measured the magnetic field of the heart generated by the heart muscle's electrical activity.[45] This energy field has been measured up to fifteen feet from the body although the increasing range of detection says more about the sensitivity of the measuring instruments than it does about the size of the field. According to James Oschman, "The biomagnetic field of the heart extends indefinitely into space. While its strength diminishes with distance, there is no point at which we can say the field ends."[46] Progress in instrumentation design has revealed the strength of the heart's magnetic field to be the most powerful in the body and research shows that cardio-electromagnetic communication can be generated through coherence building techniques.[47]

Three Steps to Coherence

There are three basic steps to creating coherence through the HeartMath® technique of Heart Lock-In; shifting attention to the heart; breathing slowly and deeply; and generating a feeling of appreciation. Shifting the focus from the head to the heart helps to disengage from stressful thinking, and is the first step to getting "the mind out of the way so that coherent, positive feelings are driving the process."[48] Integrating the shift in focus with attention to slow, deep breathing encourages the emergence of the entrainment pattern. The word "spirit" from the Latin root word, "spiritus" means breath.

Breathing moves energy and energizes the heart as it serves as a connector between the energetic and spiritual bodies.[49] Conscious breathing patterns cause peptides to disperse throughout the cerebrospinal fluid restoring balance to the body.[50] The coherent pattern is maintained through the feelings of appreciation. By practicing heart-focused breathing and sustaining feelings of appreciation and gratitude, the system comes into and maintains a state of coherence.

These are simple steps and can be done by people of all ages in different settings. Techniques designed to create heart-generated coherence have been successfully used by athletes, people in high-risk or high stress jobs, and students for test anxiety reduction and learning enhancement.

Intuition

The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honors the servant and has forgotten the gift. Albert Einstein

Research suggests that the function of the heart goes beyond physiological, emotional or psychological realms to the intelligence of the intuition. The heart has a role in the deepening of an intuitive inner connection. In a study in which participants were randomly shown either calm or emotionally invoking pictures, it appeared that the heart received and responded to intuitive information. Through measurement of skin conductance, EEG and ECG researchers found that "significantly greater heart rate deceleration occurred prior to future emotional stimuli compared to calm stimuli"[51] providing physiological evidence of the heart's intuitive perception, involving the processing of information *before* it is consciously received. The implications of this

research are profound and could lead science to a deeper understanding of the resources that lie untapped within the neural networks of the human heart.

Technology is mimicking this intuitive mode of communication. Computational neuroscience uses neural network theory, in the form of mathematical statements, modeling the brain's computing ability in creating diagnostic computers. Psychiatrists, Lewis, Amini and Lannon refer to this neural activity as "machine intuition" and write, "Because a neural network taps into the brain's own data-processing mechanism, it arrives at sophisticated, unanalyzable inferences—as does humanity's emotional heart."[52]

Henry Reed discusses his research in *The Intuitive Heart* and writes, "My discovery is that love and caring are a natural source of intuition. Intuition is most effective when it comes from caring, from a sincere wish to make a heart connection, either with your own inner self or with another."[53] Can we, as a species, listen to the wise words of Albert Einstein, quoted above, and create a marriage of the sacred gift of intuition with the faithful servant of the intellect? Perhaps this connected heart/mind partnership is truly what is needed to help our civilization solve the massive planetary problems being faced in this time of history. Whether issues of social justice, ecology, violence or hunger, the heart that beats within every person can be the link that leads to an understanding and experience of humanity's oneness and unity.

The Mystic Heart

Love is the only freedom in the world because it so elevates the spirit that laws of humanity do not alter its course." Khalil Gibran

Just as a physical and emotional heart beats within all of humanity, the mystic heart beats within all of the faith traditions. Every religion has, at its core, the universal teachings of the heart. Wayne Teasdall, lay monk and self-described "inter-mystic" shares his description of the mystic heart in that, "its maturity reflects the essential elements, gifts and genius of all the traditions of spiritual wisdom."[54] He goes on to list the universal tenets of moral capacity, solidarity among people, nonviolence, humility, service, and compassionate action that are the foundational principles of the different religious faiths.

In the book of Jeremiah, the Hebrew people are offered a teaching containing the promise of finding Yahweh that reads, "when you search for me, you will find me if you seek me with all of your heart."[55] Searching with all of one's heart implies immersing the whole self into the process rather than "half-heartedly." Israel receives a new covenant, promised with the words, "I will put my law within them and I will write it on their hearts; and I will be their God and they shall be my people."[56] A law that is written on the heart becomes a way of being that is practiced and lived, rather than read about or studied, which can lead to real transformation. The book of Proverbs is rife with descriptive references to the heart as we learn that it is the wellspring of life,[57] good medicine,[58]a reflection of the true inner nature,[59]and our downfall if it is hardened.[60]

The Christian scriptures contain similar instruction for seeking Spirit through the heart: "Love the Lord your God with all your heart and with all your soul and with all your mind."[61] This again speaks to the immersion of the whole self in the process,

leading to transformation. Words attributed to Jesus tell us, "Wherever your treasure lies, there your heart will be."[62] The heart is the pathway to the treasure that lies hidden within.

The Hindu scripture, the *Bhagavad Gita,* also directs seekers to the heart as a vehicle on the path to God. "The yogi whose heart is still, whose passions are dissolved, and who is pure of sin, experiences this supreme bliss and knows his oneness with Brahman."[63] The stillness of the heart is a common contemplative teaching on the spiritual path.

In the Islamic tradition, compassion and mercy are cited 192 times in the *Koran* and Allah is described as "the generous Lord, the gracious, the Hearer, the Near-at-Hand, the Compassionate, the Merciful, the Very-forgiving, whose love for man is more tender than that of the mother-bird for her young."[64] This tender, loving God is worshipped as the Beloved in Sufism, the mystical practice of Islam, which brings us the deeply devotional poetry of Rumi and other Sufi poets. "Sufism is to Islam what the heart is to the human being, its vital center, the seat of its essence."[65]

It is interesting to note that one of the essential similarities among all of the world religions is a variation of the Golden Rule, which is based on the practice of love and compassion with our fellow humans. Treating others as we wish to be treated is a basic principle of every religion.

Each tradition has a spiritual practice of "cardio-contemplation" designed to connect to the heart – whether it is the mindful loving kindness practice of the Buddhist, the contemplative devotion of the Christian mystic or the ecstatic dance of the Sufi

tradition, beneath the outer wrappings there lies a jewel at the center of it all, the mystic heart.

The scientific world has begun to gather evidence, pointing to the realization that exploring the power of the heart is not just a sentimental pastime but can create positive psycho-physical, mental and emotional effects. Participating in prayer and meditation can lower blood pressure, decrease heart rate, lower rates of respiration, reduce levels of cortisol and boost the immune system.[66] A meta-analysis was conducted on studies researching the effectiveness of religious involvement. The published results showed a 29% increase in longevity for those actively involved in a faith community.[67]

Viewed from this perspective, the teachings of the heart focusing on love and compassion, found in all of the faith traditions, become more than just moral codes for living. Observing the power of the heart that is unlocked through the practice of love and gratitude, the teachings to "love your enemies" and to forgive now become elevated to the realm of a transformational formula extending to many areas of life.

Perhaps Jesus had great insight into the power of appreciation when he began his prayers with the words, "thank you" before asking Spirit for what he wanted. Whether singing psalms of praise to Yahweh, meditating on the sacred words of the Lord's Prayer, making a pilgrimage to Mecca, chanting the name of Hare Krishna or sitting in silence and focusing on the breath, all of these pathways can lead to the same place, the mystical depths within the heart.

Definition of Intention

Webster defines intention as "an act or instance of determining mentally upon some action or result." It is derived from the Latin word, "intenitus," which means, "a stretching toward." For the purpose of this study, the operational definition of intention is "directed remote mental influence."[68]

Intervention Session #2 of this research project examined the effects of intention combined with heart-generated coherence (HGC) on water used to grow wheat seeds using hydroponics. The participants who applied the intervention in Session #1 practiced the HeartMath® technique, Heart Lock-In, while in close proximity to containers of distilled water (C-1). In Session #2, the same participants added intention to the protocol, as they practiced the Heart Lock-In technique, while specifically targeting containers of distilled water (C-2), with an intention for healthy plant growth.

A control group used untreated distilled water from containers (C-3). Plants from all three Plant Groups were measured and compared, using biologic plant growth as an objective marker.

Studies Using Intention

Many studies have been published showing evidence for the effects of intention on living and non-living systems. The non-human studies used intention on various targets, including water, seeds, plants, single-cell organisms, insects, animals and machines.

Non-human Studies

A meta-analysis consists of a critical and technical examination of a body of published literature. Daniel Benor published a review of 138 studies using intention on a variety of subjects, finding "statistically significant evidence for 88 of the 138 studies."[69] Benor's research suggests "that thoughts can have powerful effects on a variety of plants, seeds, single-celled organisms such as bacteria and yeast, and insects and other small animals."[70]

William Tiller conducted a study with 10,000 larvae and 7,000 adult fruit flies with the intention of increasing ATP/ADP ratio. For the experiment, he used a small black box, designed to screen incoming electromagnetic energy, known as an "Intention-Imprinted Electronic Device" (IIED). Positive intention to increase the ATP/ADP ratio was "imprinted" into the boxes. Tiller "discovered not only that the ratio of ATP to ADP had increased, but also that those larvae exposed to the imprinted devices developed 15 percent faster than normal."[71]

Conditioning of the Laboratory Space

An unexpected consequence of the IIED experiments being carried out was the "conditioning" of Tiller's laboratory over time. As he repeated the experiments, the results continued to improve. Observing oscillations in temperature, water properties and magnetic field polarity effects, Tiller noted that similar effects were not present in nearby locales. He wrote, "A totally unexpected and critically important phenomenon arose during repetitive conduct of any of these IIED experiments in a given laboratory space. It

was found that by simply continuing to use an IIED in the laboratory space for approximately 3 – 4 months, the laboratory became "conditioned" and the state of that "conditioning" determined the robustness of the abovementioned experimental results."[72] Tiller likens this effect to "sacred space" generated through the use of group prayer and meditation.[73]

Dean Radin also found that repeated distance healing intention (DHI) sessions showed an increased growth trend in cultured human brain cells as the experiment progressed.[74] These findings bring up interesting questions about the possible increased effectiveness of prayer in healing, when a group meets repeatedly in the same space and uses positive intention as part of the process.

Plant Studies

In double blind studies, Serena Roney-Dougal demonstrated a 10% increase in crop yield through the power of intention, using lettuce seeds, finding "in four of the five trials, the group of seeds randomly assigned to be enhanced by the healer outproduced the other three groups of seeds which were identical in all other respects."[75]

Through research into the nature of quantum light emissions from living organisms, Russian scientist Konstantin Korotkov, discovered increased energy field fluctuations in plants when approached with positive intention.[76]

In a series of studies, Alok Saklani researched the effects of positive intent on plant growth. Seeds held by healers with the intent to influence them for enhanced growth, were grown and compared to control groups receiving no intervention. The seeds receiving positive intention showed more significant growth than the control groups.[77]

Using a super-low-light digital camera, Gary Schwartz was able to photograph changes in biophoton imaging of geranium leaves. He discovered that leaves exposed to 15 minutes of energy healing affected their level of photon emission. "The best of these healers were able to increase or decrease the photon emission in plants as much as fivefold, and in a few cases even as much as *tenfold*."[78]

Random Event Generator

At the Princeton Engineering Anomalies Research laboratory (PEAR lab), Dr. Robert Jahn and Dr. Brenda Dunne conducted studies demonstrating the correlation of the effects of human intention on non-human systems utilizing a Random Event Generator (REG).

A REG, also known as a Random Number Generator (RNG), is an electronic device which, when unattended, creates a sequence of random binary events of "highs" and "lows" equivalent to continually flipping a coin. Instead of a coin toss, it uses positive and negative pulses that are relative to a mean value. Plotting the distribution of electron "noise" over time, data are recorded, testing for deviation due to the possible organizing influence of human intention on the random output.

After over a decade of research in which participants attempted to influence the machine, Jahn and colleagues concluded that the "random outputs tended to match the outputs that the participants intended."[79] In addition, in a meta-analysis of published REG studies undertaken in 1989, Dean Radin and Roger Nelson found trends in deviations that were in alignment with the direction of mental intention.[80]

There is no clear understanding of how a REG's random behavior can be altered by human interactions and interpretation is speculative. However, the research seems to

support the hypothesis that coherent "group consciousness" can influence the REG even without specific intentions. Work by Roger Nelson et al. “found consistent deviations from expected randomicity in data taken in situations where groups become integrated or unified by something of common interest. During deeply engaging meetings, concerts, rituals, etc., the data tend to exhibit slightly greater order than random data should, and we are able to predict this deviation with small but significant success.”[81]

In research conducted by Lonnie Nelson, a student of Dr. Gary Schwartz, it was discovered that REGs responded with increased order when the subjects were in an absorbed state. Nelson and Schwartz concluded that, “the electrons became more organized in the presence of an absorbed, organized mind.”[82] This organized, coherent state is reflected in an experiment conducted at a conference with over two thousand practitioners of Quigong. The REG “continued to deviate from chance throughout the entire weekend” demonstrating an apparent organizing influence from the minds of the practitioners.[83]

For the purpose of this study, the PI used a computer laptop and Psyleron REG-1 device to collect data during both interventions in order to research the possible effects of HCG and intention on the REG. There were statistically significant results in deviation found throughout the twenty-minute interval during which Intervention #1 was being conducted (See Graph in Figure 5). This result is generally correlated with a high degree of group coherence and would suggest that the HGC practitioners attained and sustained an elevated level of coherence during Intervention #1.

Human Studies

Distance healing intention (DHI) is defined as "a compassionate mental act intended to improve the health and well-being of another person at a distance."[84] Research suggests that compassionate intention can influence healing in the human body. In a meta-analysis of 55 DHI experiments, reporting on more than 1400 sessions, a research team headed by psychologist Stefan Schmidt concluded that the studies showed "a small, but significant effect" with no selective reporting or relationship between study quality and outcome.[85]

In a double blind, randomized study, led by cardiologist Randolph Byrd, patients in a coronary care unit were prayed for by home prayer groups. Each patient in the experiment had five to seven people praying for him or her. One of the difficulties in conducting a study on healing prayer is that there is no certainty that the "pray-ers" actually prayed when they said they would or that they were sincere when they prayed. Since the participants were not given instructions on how to pray, there is also the question of whether certain types of prayer are more effective than others. Another question that arises in the Byrd study is whether the control group had family and friends praying for them.[86] Moreover, it would be considered unethical to limit the prayer support for any patient.

Despite the study's design challenges, Byrd found differences in several areas between the two groups. Fewer of the prayed-for patients died during the study, were five times less likely to require antibiotics, three times less likely to develop pulmonary edema, and did not require endrotracheal intubation.[87]

Larry Dossey describes a study in which William Braud and Marilyn Schlitz researched the effect of DHI in creating a physiological influence in the human body as measured by electro-dermal activity. Using mental imagery and self-regulation techniques, influencers tried to exert a calming or activating effect on the subjects. They found that the "intentions seemed to 'get through' to the subjects. The effects proved to be consistent, reliable, and robust."[88] Dossey concludes that both prayer and imagery have the ability to bring helpful changes in the body at a distance.[89]

Dean Radin, in the so-called "Love Study," researched the effects of compassionate healing intention between couples and found a synchronization of brain-wave response between "senders" and "receivers." Interestingly the effects strengthened with emotion. "The EGG readings of the receiver were significantly higher and correlated with those of the sender when the sender experienced strong emotions, positive or negative."[90]

In studying the neural mechanisms that underlie intention, researchers Lau, Rogers, Haggard and Passingham used functional magnetic resonance imaging to compare neural response with self-reported moment of intention to move. They discovered a correlation with "enhancement of activity in the pre-supplementary motor area" (pre-SMA) as well as "activations in the right dorsal prefrontal cortex and left intraparietal cortex." The conclusion of their study was that the recorded neural activity reflected the representation of intention.[91] When the participants paid attention to the intention to move, there was enhanced activity in the pre-SMA. The attention that is focused on intention could be a relevant factor in determining the successful outcome of the effectiveness of the intention.

In the Christian scriptures, we find many stories of the healing ministry of Jesus, including curing the sick[92], raising the dead[93], helping the blind to see[94], and the lame to walk.[95] The key to this remarkable healing ability may lie in the curious meaning of the word prayer, in the Aramaic language used by Jesus, which means "to set a trap." What is being captured? The Aramaic word translated as God means "life force." Using these definitions, it implies that this type of healing work is a method of "catching" the life force or spiritual essence and directing it in a way that helps to restore wholeness. Could this be an ancient form of energy healing?

The Role of Belief

Belief in one's ability to accomplish a task is a prerequisite for bringing it forth. Conversely, belief that something is impossible is a deterrent to success. How much does belief or expectation affect the outcome of healing and intentionality?

The placebo effect has long been studied in scientific research. Belief that a medical procedure can positively affect one's health has the potential of having a therapeutic effect even if the treatment is, in fact, a sugar pill or other sham intervention. Larry Dossey reports cases of people who have even become addicted to placebos that they believed were habit-forming drugs. [96] Dr. Bruce Moseley discovered that patients receiving "fake" knee surgery improved as much as two groups receiving the surgery. He concluded that his "skill as a surgeon had no benefit on these patients. The entire benefit of surgery for osteoarthritis of the knee was the placebo effect."[97]

The opposite is the "nocebo" effect in which a pessimistic belief has undesirable effects. Researcher Gail Ironson studied the link between belief and the immune system

with AIDS patients. She discovered that those patients who believed in a punishing God lost white blood cells at twice the rate of those who believed in a loving God.[98] It would appear that a belief that one would be punished for contracting the disease could contribute to the "punishment" of ill health actually being manifested.

On the other side of the coin are the physician's beliefs. In three double blind studies examining the use of vitamin E in treating angina pectoris, the doctor's belief or skepticism in vitamin E was a significant factor in the resulting effectiveness of the intervention.[99] This study reveals the importance of choosing a medical care professional who believes in the treatment being used in the healing process.

How effective is belief in bringing forth significant results in intention experimentation? Researcher Gregg Braden in his book, *The Spontaneous Healing of Belief,* reports on an intention experiment entitled the International Peace Project, which was published in the *Journal of Conflict Resolution* in 1988. It involves a group of people during the war between Lebanon and Israel that began in 1982. Participants were trained to meditate in order to feel peace in their bodies and to believe that peace was already present, rather than praying for it to occur. At specific times, the meditators were positioned throughout the war-torn areas of the Middle East and during the times that they meditated and felt peace, terrorist activities lessened, crime rates lowered and hospital visits declined.[100]

Gary Schwartz asked participants in a research study to rate their level of belief in their ability to sense energy. Those who rated themselves at a high level performed better than those who believed themselves to be energy insensitive.[101] William Braud, in researching the ability of a subject to exert time-displaced influence, discovered the

subject's scoring improved dramatically when reminded of previous success in a similar study.[102] These studies bring up the question of the possible link between ability and belief. Did the beliefs of the HGC practitioners in their ability to influence the water have an effect on the result?

Empathy

The word, "empathy" is defined as "the identification with the thoughts and feelings of another." This ability to "feel with" someone seems to be a factor in the effects of distant intentionality (DI) as demonstrated in a study by mind-body researcher, Jeanne Achterberg. Working with indigenous healers, Achterberg researched the power of DI and empathy. For the first trial, the healers chose a person they knew and had empathy with, randomly sending them DI. The second trial used people with whom they had no empathic bonding as a control. In analyzing the brain scans of all of the subjects, correlated sender/receiver brain activity was found with the empathic group but not with the control. The findings suggested that empathy plays a role in the effects of DI.[103]

Studies have investigated the physiological effect of empathy on spouses, finding that in partners "adept at empathizing, their physiology mimicked their partner's while they empathized."[104] Through this type of observation, other studies were able to predict divorce probabilities based on ability to empathize.

Gary Schwartz, in a follow-up study from 1957 involving Harvard undergraduates, discovered a correlation between feelings of parental love and ability to receive cardiac signals from others. He writes that "if the subjects perceived their parents as loving when they were in college, they registered the presence of the interviewer's

heart waves in their brain waves when they were mature adults."[105] Blake Bowden from Cincinnati Children's Hospital surveyed 527 teens aged 12 to 18 and found that those who ate daily meals with the family were more motivated, optimistic and had a reduced tendency to smoke, or abuse drugs and alcohol. Pearsall suggests that aside from the empathic relationship of family as an explanation for these findings, the bonding of subtle energy of the heart could also be a factor.[106]

Witnessing others in an empathic role can have a positive effect on our physiology. In 1988, sixty-six Harvard students were shown a film of Mother Teresa caring for orphans in Calcutta while a second group saw a film about World War II. A saliva swab was taken from each student before and after watching the films. The group that watched Mother Teresa showed an increase in their S-IgA immunoglobin A levels.[107] Exposure to another's empathy opens the heart and boosts the immune system.

Empathy appears to play a role in the therapeutic relationship. Larry Dossey writes, "The majority of healing studies suggest that a healing effect is real…mediated by compassion and empathy."[108] The concept of HGC energy exchange is the basis of many healing modalities in complementary medicine, and underlying the concept is the assumption that healing is facilitated through this exchange.

Research involving the "hands on" energy healing practices of Reiki and Johrei found that both modalities had a positive effect on health. Reiki was used in a study using laboratory rats that had been stressed. By administering an energy flow through the hands to the rats, the practitioner was able to positively affect heart rate and blood pressure.[109] In the case of Johrei, through conductance of energy through the hands, the practitioner succeeded in affecting emotional states, both in decreasing negative emotion and

increasing positive emotion.[110] The above-mentioned studies suggest that there is a deeper energetic connection between people that can be accessed when in a state of coherence.

Importance of Water

> *Behold the element of water in its undifferentiated state! And then see how all the metals, all the stones, all the glittering rubies, shining carbuncles, crystals, gold, and silver are derived from it; who could have recognized all these things in water?* Paracelsus c 1531-35

Referring to water as the "matrix of the world and of all its creatures," Paracelsus, in the above quote,[111] eloquently expounds on the value of water to life on planet earth. Water's significance becomes evident when considering its scientific role in the processes of living. The human body consists of approximately 70% water,[112] with brain and lungs made up of 90%, which suggests its biological importance for living beings. The effects of chronic dehydration have been linked to poor health. "Dehydration creates an imbalance in your inner chemistry that sparks a cascade of negative effects contributing to virtually any health problem or disease process."[113]

Water is a fascinating substance that is vital to human life.

This fascination comes, in part, from observing its unique properties. With its high surface tension, by increasing equivalent volume, water can support denser objects without sinking, and yet will yield to form the shape of its container. It is compliant while wearing down the most solid of rock formations through repeated movement. Water is the only substance on earth that exists naturally in three forms of solid, liquid and gas. It

is a universal solvent and serves as a lubricant for other elements in their biogeochemical cycles.

Water is carried on an unending journey through the hydrologic cycle, as it is recycled through precipitation, drawn upward through tree roots, traveling against gravity to leaves and transpired back into the atmosphere. Physicist Phillip Ball writes, "Each 3100 years, a volume of water equivalent to all the oceans passes through the atmosphere, carried there by evaporation and removed by precipitation."[114] Two thirds of the planet's surface is covered in water, prompting Ball to write, "We call our home Earth—but Water would be more apt."[115] The planet's oceans are home to countless aquatic life forms, and, along with the polar ice caps have an enormous effect on global weather patterns. Clearly, the importance of water in its various forms in regards to physical life cannot be overstated and references to it are found in all of the world's sacred texts and mythology.

Spiritual References to Water

Ironically, a substance considered so common has an unmistakable air of mystery to it. The word, "water" is referred to over 700 times in the biblical scriptures.
In the Hebrew scripture, the creation story begins with God moving over the face of the water before proclaiming the existence of light.[116] This idea of a watery beginning is echoed in creation tales from many cultures including Hindu, Native American, Russian and Asian. The ancients believed the world originated from and was founded upon a watery abyss. Water plays an important role in several biblical legends: Noah navigates

the flood,[117] Moses parts the Red Sea[118] and Jonah ends up being thrown overboard and lands in the belly of a big fish.[119]

In the Christian tradition, the sacrament of baptism signifies purification. As Jesus was being baptized in the River Jordan, the Spirit of God descended upon him[120]. Early in his ministry, Jesus turned water into wine,[121] and continued in this sacred interaction with water as he walked on its surface,[122] calmed the sea,[123] instructed his disciples to cast their nets into it, drawing forth a surprising abundance of fish after a night of fruitless fishing,[124] and offered spiritual life in the form of "living water" to the woman at the well.[125] It is recorded that Jesus spent time during his last night with the disciples washing their feet.[126] Symbolically, his ministry began by being cleansed by his forerunner and comes to a physical close as he cleanses his followers.

Water is often used as a metaphor to illustrate spiritual principle. Lao Tzu writes in the *Tao te Ching*, "Nothing in the world is as soft and yielding as water. Yet for dissolving the hard and inflexible, nothing can surpass it."[127] Water is a perfect example of the true strength of non-resistance. The Buddha counsels his followers by illustrating the method of creating life experience, through the metaphor of water irrigation. "As an irrigator guides water to his fields … the wise shape their lives."[128] In other forms of mythology, the Lady of the Lake, sea serpents, water spirits, sirens and mermaids all illustrate our universal fascination with water.

Research Studies Using Water

Reviewing research studies investigating the effects of intention and heart-generated coherence on the properties of water, the fascination increases. William Tiller

said, “Abundant data now exists to show that water, structured by applied electric and magnetic fields of a variety of configurations and magnitudes, beneficially influences seed germination, plant growth and a human’s sense of beverage softness and flavor as well as personal physical well-being.”[129]

Directed Positive Intention

Many excellent studies of energetic changes of water and other living systems have been published, demonstrating the effects of directed positive intention and coherence. Japanese researcher, Dr. Masaru Emoto studied samples of water that had been exposed to various stimuli, such as music, and positive or negative words. The samples were then frozen at –25 degrees C and observed under a microscope. Published photos of the results show that symmetrical, aesthetically pleasing crystals were produced when exposed to positive words and classical music, while poorly formed, unattractive crystals developed in response to negative words and heavy metal music.[130]

Emoto’s work has been brought into question and labeled “pseudo-science” as no control group or blinding was used in his research and all crystal images recorded were not published, suggesting a selection bias in reporting of results.[131] In order to replicate Emoto’s results using scientific rigor, Dean Radin led a double blind experiment using intention. Neither those participating in the intervention, the analysts photographing the crystal formations, nor the participants judging the resulting images knew which samples of water had received the intervention. “Results indicated that crystals from the treated water were given higher scores for aesthetic appeal than those from the control water (P =.001 one-tailed), lending support to the hypothesis.”[132]

Sandra Ingerman conducted research examining the use of intention in affecting the earth's environment. After contaminating water with ammonium hydroxide, an environmental pollutant, Ingerman led a group of people in a ceremony of intention aimed at changing the pH level of the water and successfully lowered it from 1-3 points to a neutral level.[133] A research project led by Bernard Grad of McGill University in Montreal tested biologic effects of "laying on of hands". Two healers held a bottle of water in their hands for thirty minutes. Use of the treated water increased carbon dioxide production in yeast cultures in four of five tests.[134]

Through analysis by infrared spectroscopy, Grad discovered the water had undergone changes in the molecular makeup similar to water exposed to magnets. This was confirmed by Russian research demonstrating structural changes through data that indicated, "some human operators can produce a consciousness-related influence on water structure."[135] In yet another study, using infrared spectrophotometry, Stephan Schwartz measured changes in oxygen hydrogen bonding in bacterial-static water that was held by therapeutic practitioners during healing sessions.[136] It appeared that the water was being affected through the healing hands of positive intention.

What about water found in sacred sites? Does human consciousness influence water structure? Researchers from HeartMath® conducted analyses into the structural properties of so-called "Marian water," water taken from sacred sites such as Lourdes, France; Medjugorje, Croatia and Fatima, Portugal. They discovered modifications in pH levels and significantly enhanced growth rate of bacteria and fungi when grown in media using the Marian water.[137] An interesting question to consider would be whether the

water is sacred because of its location or because people visiting the sacred sites join in prayer near the water.

Professor Konstantin Korotkov, from the Russian Academy of Natural Sciences, developed the Gas Discharge Visualization (GDV) technique used to photograph the biophoton emissions from living things. Using the GDV, Korotkov conducted research on the connection between biofields and consciousness. In studies focusing on the effects of human emotion on water, he concluded that, "love increases water's energy levels and stabilizes the water, while aggressive emotions reduce the energy and make radical changes in the water."[138] If our thoughts and feelings can change the energy of the water, and our bodies are made up of 70-90% water, the implications are that we have the ability to positively affect our physiological health.

However, the effects go beyond energetic changes to actually influencing physiological systems. Researchers Rein and McCraty studied the effects of intentionality and HGC on distilled water using DNA and measuring structural changes to the water as well as testing its ability to affect a biological system. Their results indicated "the water structured in the above experiments facilitates the spontaneous tendency of DNA to rewind (decrease absorbance)."[139] The apparent ability of heart-directed intentionality to influence DNA raises profound implications as to the heart's ability to influence growth processes and basic cell functions of the body.

Memory of Water

Work conducted by Dana Tomasino discovered evidence supporting the hypothesis demonstrating that "water is a liquid crystal with a pliable lattice matrix that is

capable of adopting many structural forms. The structure of water gives it an infinite capacity to store information within its matrix."[140] Tomasino describes water as an "accumulator, transmitter and transducer of energy patterns and information [as it retains] energetic memory of vibrational frequencies."[141]

In the mid 1980's, French scientist Jacques Benveniste discovered the apparent memory of water during repeated experiments involving dilution of anti-IgE antibodies similar to homeopathic preparations. Despite continued dilution of the substance, until none of the original molecules remained, the antibodies still produced the same response. His conclusion was that information was, perhaps, transmitted through a hydrogen-bonding network.[142]

Professor Rustum Roy, of Pennsylvania State University, explains this phenomenon by saying that the water "remains water, but its structure, like a nervous system, reacts to any vibratory wave form. Modern instruments have made it possible to record the fact that within each of water's memory cells there are 440,000 information panels, each of which is responsible for its own type of interaction with the environment. The stability of the cluster structures [confirm] the hypothesis that water is capable of recording and storing information."[143]

The implications of this body of research are startling. What if humans might learn to consciously practice simple, straightforward techniques such as the HeartMath® Lock-In and directed positive intention, and in practicing these techniques, alter the effect that water in their proximity will have on plant growth? What does that say about the human potential for healing the body and creating conscious, beneficial, subtle energetic

effects on the biological systems of the planet? Might this be one of the most powerful potentials we have to offset the damage that has been done to many of these systems?

Why Distilled Water?

The pH (percent hydronium ion) scale measures alkalinity and acidity through levels of positive or negative ions. On the pH scale, distilled water is neutral. The distillation process mirrors the hydrologic cycle as the water evaporates, condenses and becomes precipitation. Impurities are separated from the water and remain as residue, leaving the water pure and free of toxins and waste. Emoto used distilled water in his testing due to its neutrality. "Distilled water was chosen as a control. It usually forms a simple, standard hexagonal shape."[144] For this study, the interest of the PI was in observing what effect the electromagnetic field of the human heart may have had on water in this neutral state.

Hydroponic Systems

The term "hydroponics," also known as nutrient-solution culture, dates from the late 1930's and refers to a method of plant growth, without the use of soil, through the immersion of plant roots into a diluted solution of nutrients. Although the use of hydroponics eliminates problems of poor soil, weed growth and inadequate drainage, there are also disadvantages, including higher cost, possibility of disease through lack of soil filtering and greater responsibility for maintaining a healthy growing environment through proper pH and chemical balance.

Horticultural rockwool can be used as a hydroponic substrate in propagating plants. Made from melted rock spun into fiber, the rockwool is pressed into slabs, creating a porous, stable growing medium that delivers uniform dispersion of nutrient solution.

Nutrient formulae, although comparable, may differ depending on the type of plant grown. The solutions supply varying ratios of nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese and boron. Deficiencies in any of these elements will show up as various symptoms in the plant and will necessitate solution adjustment.[145]

Conclusion

> *May we turn inwards and stumble upon our true roots in the intertwining biology of this exquisite planet.* John Seed

What are the implications for the power of HGC and intention on water? Deepak Chopra's claim that our cells have memory prompts the question, "Could it be the water in the cells that is creating this phenomenon?" Since our body is essentially a container of water, it stands to reason that our physical, mental and emotional health could be affected by the energetic memory of the water that hydrates our cells.

Similar to the body, the earth is made up of three-quarters water. Water's life-supporting importance cannot be understated, and the care of this essential natural resource is critical to our very existence on the planet. Harmful substances are adversely affecting our lakes, rivers and oceans. The pollution appears to be occurring either directly, as in the case of the Exxon Valdez spill, or indirectly, for example, in the form

of fertilizer run off. More recently, pharmaceuticals have been found being flushed into waste water. With such troubling threats to the environment, the question arises, could the practice of HGC and intention have roles in the healing of the precious, life-giving substance of water?

The above-cited studies suggest that intention has the possibility to positively influence both human and non-human targets. Dean Radin writes, "Possible effects of direct intention have been studied in the context of the role of intercessory prayer in distant healing. Another class of studies has focused on the role of intention in affecting a distant person's physiological state, a third is the effect of intention on other living systems such as animals, cells, and bacteria, and a fourth involves a range of nonliving physical systems. The cumulative experimental evidence in all four areas is positive."[146]

The evidence reported, suggesting implications of the effects of intention in both non-human and human studies, points to the possibility for planetary healing. Looking within ourselves, we can discover the power that our thoughts, beliefs and emotions demonstrate in affecting our own healing. If, as studies have indicated, love can increase the energy and stability of water[147] and pH levels can be changed by intention,[148] then the possibility arises that through our intertwining biology, we have the ability to positively impact our world. As Lynne McTaggart writes, "Today a leaf, but tomorrow the world."[149]

CHAPTER 3:
RESEARCH METHODS

The study used a randomized, pre-measurement/post-measurement control group design. In a sixteen-day research project, eight Heart-Generated Coherence (HGC) practitioners, who are members of Unity church and trained in the HeartMath® technique called Heart Lock-In, took part in two separate intervention sessions. The purpose of the study was two-fold:

a) To ascertain the growth effects on a group of wheat seeds, planted and grown in water that had been "conditioned" by being in the presence of persons as they practice the HeartMath® Heart Lock-In technique (Intervention #1).

b) To ascertain the growth effects on a separate group of wheat seeds, planted and grown in water that had been "conditioned" by being in the presence of the same participants as they practiced the HeartMath® Lock-In technique while generating intention for positive plant growth towards the water (Intervention #2).

The study was done with three groups of wheat seeds, using fifty-four seeds assigned to each group. Plant Group A (PG-A) and Plant Group B (PG-B) received specific interventions, and Plant Group C (PG-C) acted as a control group with no intervention. The water was stored in twelve 1-gallon containers, four labeled (C-1), four labeled (C-2) and four labeled (C-3). The interventions took place at the home of the Principal Investigator (PI) on Saturday, October 10, 2009 from 1:00 p.m. to 3:00 p.m.

Intervention #1 took place in Training Room (T-R) while Intervention #2 took place in Intervention Room (I-R).

Participants applying the intervention to (PG-A) and (PG-B) consisted of eight adults from Unity church, trained in HeartMath® techniques, who were able to sustain a high level of coherence as measured through the EmWave PC® heart rhythm monitor feedback system.

Prior to the research study date, each of the eight HGC Practitioners met individually with the PI to:

- Test and record coherence levels (See Appendix E)
- Read and sign an informed consent form (See Appendix A)
- Obtain directions to the home of the PI
- Be given a general oral overview of the HGC practitioner's role in the study
- Receive answers to any questions that may have arisen

Pre-Intervention

On Saturday, October 10, 2009 at 12:00 noon Central Time, the Psyleron REG-1 Random Event Generator was activated. Between 12:50 p.m. and 1:10 p.m. all eight HGC practitioners arrived at the home of the PI.

HGC practitioners were greeted at the door upon arrival and invited to sit in the Break Room (B-R) located at the north end of the upper level in the home of the PI until everyone had arrived. Each HGC practitioner was given a short Participant Pre-Survey to answer (See Appendix B).

Independent Variable

The independent variables consisted of two 20-minute sessions. The PI instructed the group prior to each intervention. Each participant was tested on their ability to reach a high level of coherence as measured by the Em-Wave PC® heart rhythm monitor prior to being accepted into the study.

Intervention Session #1

During Intervention Session #1 (IS-1), the HGC practitioners were instructed to enter the Training Room (T-R) located in the lower level of the home of the Principal Investigator (PI). In the T-R, eight folding chairs were positioned in a semi circular design with a 6-foot table placed perpendicular to and 37" away from the open end of the semi circle. Under the table, positioned on top of a cardboard box, were placed four gallons of distilled water in four containers, each container labeled C-1. A tablecloth was draped over the table to hide the water from view.

The HGC practitioners were instructed to choose a seat. In order to preclude "intention" in this session, the participants were unaware of the presence of the water and were told, "The only activity in this session is practice of the Heart Lock-In technique." The PI led the HGC practitioners through the following steps:

1. Shift attention to the heart
2. Breathe slowly and deeply
3. Activate a feeling of appreciation

4. Continue breathing into the heart and allow appreciation to radiate

At 1:15 p.m., the PI instructed the HGC practitioners to continue practicing the Heart Lock-In for 20 minutes. The PI set the timer for 20 minutes and left the room as the HGC practitioners continued to practice the Heart Lock-In technique.

After completion of Intervention Session #1 at 1:35 p.m. the PI returned to the room and instructed the HGC practitioners to end the practice and convene in the B-R for a recess. When T-R was vacated, Research Assistant (RA) removed the four containers of water (C-1) and transported them to the greenhouse.

Water from (C-1) was used to hydrate the wheat seeds in Plant Group A (PG-A).

Recess between Interventions

During the recess, the PI met with each HGC practitioner individually and tested coherence levels with the Em-Wave PC in the Test Room (Te-R) located in the south end of the upper level of the home of the PI. Coherence levels were recorded for each HGC practitioner (See Appendix F).

The Research Assistant (RA) moved the eight folding chairs to the Intervention Room (I-R), located in the northeast corner of the home of the PI, set up the chairs in a semi-circular design and placed a small, rectangular, covered wicker basket, perpendicular to and 37" from the open end of the semi-circle. On top of the basket, the RA placed four containers of water (C-2) in plain view. Upon completion of the coherence testing, the PI instructed the HGC Practitioners to convene in I-R.

Intervention Session #2

During Intervention Session #2 (IS-2), the participants were aware of the presence of the water (C-2) and were asked to focus on the specific written intention for healthy plant growth, and direct it towards the water, while practicing the HeartMath® Lock-In technique for twenty minutes. Each practitioner was presented with a slip of paper upon which was written the intention, "We intend that this water support vigorous and healthy growth in wheat seedlings."

The PI led the group in the steps of the Heart Lock-In:

1. Shift attention to the heart
2. Breathe slowly and deeply
3. Activate a feeling of appreciation
4. Continue breathing into the heart and allow appreciation to radiate

As the group continued to practice the Heart Lock-In, they were instructed to speak aloud the intention together three times and then silently direct it to the water.

At 2:21 p.m. the PI set the timer for 20 minutes and left the room while the HGC practitioners continued to practice the Heart Lock-In, while silently directing the intention to the water, "We intend that this water support vigorous and healthy growth in wheat seedlings."

After 20 minutes, at 2:41 p.m. the PI returned to the I-R and instructed the HGC practitioners to end the practice. The RA removed the containers of water (C-2) and

transported them to the greenhouse, placing the containers two feet from containers (C-1).

Returning to the B-R, the HGC practitioners were given a post-intervention survey to fill in before leaving (See Appendix C).

Control Group C

Four one-gallon containers of untreated distilled water (C-3) were used to hydrate the control Plant Group C (PG-C). The RA transported the containers of untreated water to the greenhouse and placed them two feet away from containers (C-2).

Plant Group Study Design

Wheat seeds randomly assigned to experimental Plant Groups (PG-A), (PG-B) and (PG-C.) Each seed was weighed using an Acculab Vicon Electronic Precision Scale and seed weights were recorded. Wheat seed specimens were grown using hydroponics and measured. A total of 162 wheat seeds were randomly assigned: 54 wheat seeds were assigned to Plant Group A (PG-A) using water from containers (C-1); 54 wheat seeds were assigned to Plant Group B (PG-B) using water from containers (C-2); and 54 wheat seeds were assigned to Control Plant Group (PG-C) using water from containers (C-3) which received no intervention. After sixteen days, the wheat plants from all three Plant Groups were harvested, measured, weighed and compared.

The study used a randomized pre-measurement post-measurement control group design. Treated and untreated distilled water was used as the watering base for three 16"

x 24" x 6" hydroponics trays, (T-1), (T-2) and (T-3). The Research Assistant (RA) planted 162 wheat seeds using horticultural rockwool growing medium at a depth of 2.5 cm within Trays (T-1), (T-2) and (T-3). There were 54 wheat seeds within (T-1) watered from containers (C-1); 54 wheat seeds within (T-2) watered from containers (C-2); and 54 wheat seeds within (T-3) watered from containers (C-3) which received no intervention. (See Figure 1)

Figure 1. Plant Groups A, B and C inside of greenhouse during growth period

All trays were placed in a greenhouse constructed on the south end of the home of the PI. It was an attached wooden lean-to structure measuring 5’5” ft. in height x 4 ft. in depth x 11.5 ft. in length, consisting of clear plastic windows with a wooden frame. (See Figure 2)

Figure 2. Greenhouse constructed for the research project.

Trays (T-1), (T-2) and (T-3) were separated from each other by a distance of two feet during the growth period. They were kept at the same temperature and supplied with equal amounts of a nutrient supplement that was added to the water. Each tray had a separate pumping system for contained water circulation, eliminating the need for additional watering. An electric heater was used to heat the greenhouse to temperatures between 15 degrees and 25 degrees Celsius. (See Figure 3)

Figure 3. Greenhouse was heated to temperatures between 15 and 25 degrees C.

After sixteen days, the wheat plants were harvested from trays (T-1), (T-2) and (T-3) by the RA. The post- intervention measurements were administered by the RA in the home of the PI. Each wheat plant was:

- Harvested at the base of the horticultural rockwool medium
- Measured in length using a stainless steel 30 cm measuring ruler
- Weighed using an Acculab Vicon Model VIC-123 Electronic Precision Scale

All measurements were recorded by the RA. Using a 3 x 2 mixed design analysis of variance (ANOVA), analyses were conducted to calculate the mean and standard deviation for the scores of each Plant Group to determine if significant variation existed in the results of the study groups. (See Appendix D for statistical detail)

The study took place at the home of the PI, 1016 SW Lakeview Blvd., Lee's Summit, MO 64081. The research activities covered a sixteen-day period from Saturday, October 10, 2009 to Monday, October 26, 2009.

Research Participants Applying Intervention

HGC practitioners completed and returned an Informed Consent Form before participating in the intervention. (See Appendix A) A protocol approved by the Institutional Review Board was followed for each volunteer. (See Appendix J)

Inclusion Criteria

All participants applying the intervention met the following inclusion criteria:

- Age restriction of 18 years of age or older
- Member of Unity church
- Willingness to participate in the study and sign an informed consent form (See Appendix A)

- In good health and not currently receiving medical care for any heart-related illness
- Trained in HeartMath® techniques and able to sustain a high level of coherence as measured, prior to acceptance into the study, by an EmWave PC® heart rhythm monitor feedback system

Exclusion Criteria

Participants were excluded who:

- Were currently receiving medical care for heart-related illness and/or using prescribed heart medications
- Were unable to sustain a high level of coherence as measured, prior to acceptance into the study, by an EmWave PC® heart rhythm monitor feedback system

Instruments Used During Data Collection

Wheat seeds from each group were weighed using an Acculab Vicon Model VIC-123 Electronic Precision Scale before receiving the intervention. Wheat plants from each group were weighed post intervention to determine the rate of plant growth. Wheat plants were measured from the horticultural rockwool growing medium line using a stainless steel 30 cm measuring ruler.

The HGC practitioners practicing the heart coherence techniques were tested, prior to acceptance into the study, using the Em-Wave PC® heart rhythm monitor to determine their attainment of a high level of coherence.

The Em-Wave PC® heart rhythm monitor is an interactive hardware/software system that records beat-by-beat changes in heart rate using an electronic ear sensor and analyzing heart rhythm patterns. The scale of the heart rhythm graph is determined by time axis and heart rate axis settings. Time axis settings range from 5 to 60 seconds per division, with a default setting of 30 seconds; heart rate axis settings range from 2 to 20 beats per minute, with a default setting of 10 beats.

The entrainment ratio bar chart records a continuously updated view of the user's entrainment ratio score of low, medium or high, reflecting average levels of entrainment reached during the user's monitoring session. The information is updated every five seconds in correlation with heart rhythm patterns. As the data are continuously added, the program averages the ratios and adjusts the levels throughout the session.

"The coherent mode is reflected by a smooth, sine wave-like pattern in the heart rhythms (heart rhythm coherence) and a narrow-band high-amplitude peak in the low frequency range of the HRV power spectrum, at a frequency of about 0.1 hertz."[150] All HGC practitioners were required to attain and sustain a high level of entrainment in order to apply the intervention.

For the purpose of this study, the PI used a computer laptop and Psyleron REG-1 device to collect data during both interventions in order to research the possible effects of HCG and intention on the REG.

Measures Taken For Possible Confounding Factors

The following measures were taken for possible confounding factors in this research study:

- During Intervention Session #1 (IS-1), participants may naturally have sent positive intention to the container of water (C-1) as part of the process of practicing the HeartMath® Lock-In technique, without being instructed to do so. In order to control for this factor, participants were unaware there were containers of water (C-1) in close proximity, as it was hidden from view under the table.
- Wheat plants could have received unequal amounts of water or nutrients due to soil quality during the growth period. In order to control for this confounding variable, the study used hydroponics with distilled water and carefully measured, specific plant nutrients in the water.
- To control for subtle energy bias, the PI was blinded to any information pertaining to the water, seeds and plants during the research. The PI did not enter the greenhouse or handle water, seeds or plants during the duration of the research project. Only the RA had access to the greenhouse, seeds and plants.
- To control for possible transference of the effect of the intervention between containers of water, the containers (C-1) and (C-2) were individually transported to each intervention room. They were removed immediately, post-intervention, to the greenhouse. Trays (T-1), (T-2) and (T-3) were placed in the greenhouse, each separated by a two-foot space, during the growth period.

Qualitative Methods

Each HGC Practitioner was given two surveys to answer, one pre-intervention and one post-intervention:

- Participant Pre-Survey (See Appendix B)
- Participant Post-Survey (See Appendix C)

Researchers' Roles

The role of the Principal Investigator was to:

- Identify eight HGC practitioners and invite them to participate into the study
- Schedule and conduct an individual interview with each HGC practitioner in order to test and record coherence levels using an Em-Wave PC® heart rhythm monitor, give directions to the home of the PI, answer any questions that may have arisen and have each HGC practitioner read and sign an Informed Consent Form
- Set up Training Room (T-R) for Intervention Session #1 and Intervention Room (I-R) for Intervention Session #2, with the assistance of the RA, prior to each intervention
- Set up Break Room (B-R) and Test Room (Te-R) prior to arrival of HGC practitioners
- Administer Participant Pre-Survey (See Appendix B)
- Instruct all HGC practitioners prior to each intervention
- Time each intervention
- Test individual coherence levels in Break Room (B-R) using an Em-Wave PC® heart rhythm monitor during the recess between interventions
- Administer Participant Post-Survey (See Appendix C)
- Send pre- and post-measurement weight scores to statistician to ascertain results
- Report results to all HGC practitioners upon completion of the study

The role of the Research Assistant (RA) was to:

- Build a greenhouse constructed on the south end of the home of the PI. It was an attached wooden lean-to structure, measuring 5'5" ft. in height x 4 ft. in depth x 11.5 ft. in length, consisting of clear plastic windows with a wooden frame.
- Set up a Training Room (T-R) for Intervention Session #1 and Intervention Room (I-R) for Intervention Session #2 ,with the assistance of the PI, prior to each intervention
- Transport water from containers (C-1), (C-2) and (C-3) to the greenhouse post-intervention
- Randomly assign 162 wheat seeds to plant groups with 54 wheat seeds assigned to each group (PG-A), (PG-B) and (PG-C)
- Weigh each wheat seed using the Acculab Vicon Model VIC-123 Electronic Precision Scale
- Record each weight
- Label each seed
- Fill each tray with assigned water post-intervention
- Measure and cut horticultural rockwool growing medium and insert in tray with six equal pieces used per tray
- Plant wheat seeds in horticultural rockwool growing medium at an equal depth of 2.5 cm. for each wheat seed as follows: for PG-A, 54 wheat seeds within (T-1) using water from containers (C-1); for PG-B, 54 wheat seeds within (T-2) using water from containers (C-2); for PG-C, 54 wheat seeds within (T-3) using water from containers (C-3) receiving no intervention.

- Photograph wheat plants during growth interval
- Monitor greenhouse temperature and tray water levels for Trays (T-1), (T-2) and (T-3) during growth period
- Harvest all wheat plants after a sixteen day growth period, severing each plant at the horticultural rockwool growing medium base
- Weigh each plant with the Acculab Vicon Model VIC-123 Electronic Precision Scale
- Measure length of each plant harvested from the distance of the rockwool growing medium base to top of the blade
- Record weights and measures of each plant (See Appendix D)

Data Sources

Data sources for the foundation of this study were gathered from peer-reviewed articles and scholarly journals in the fields of alternative therapies, transpersonal psychology and holistic medicine as well as in the topics of stress management, consciousness studies, distant intentionality, spirituality, electromagnetic cardiac resonance, and the study of water. In addition, literature from the above modalities was used to create the Review of Literature in Chapter 2.

Ethical Considerations

The PI abided by the ethical standards as set forth in the Ethics and Academic policy of Holos University Graduate Seminary. HGC practitioners' identities and

information is confidential. Protocol reviewed by the Institutional Review Board was followed. (See Appendix J)

Pilot Study Results

A pilot study was undertaken by the PI and RA prior to the research project to research and determine most effective:

- Amount of water
- Type of seed
- Growth interval

Using Tray #1 (T-1), untreated distilled water and individual horticultural rockwool growing medium seed cubes, the PI planted the following seeds:

- Hard wheat
- Soft wheat
- Rye
- Lettuce
- Sunflower
- Barley

It was determined from the two-week pilot study that hard wheat seeds, four gallons of water and approximately two weeks would be the most efficient choices for the purpose of this study.

CHAPTER 4:
RESEARCH FINDINGS

Data Collection

In this chapter, data collection procedures are reported, along with statistical data and analyses in regards to the hypotheses put forth in this study. Data were collected through the following measures:

- Em-Wave PC® heart rhythm monitor was used to record heart-generated coherence level scores for HGC practitioners
- Participant Pre-Survey was conducted pre-intervention (See Appendix B)
- Participant Post-Survey was conducted post-intervention (See Appendix C)
- Seeds were weighed using Acculab Vicon Model VIC-123 Electronic Precision Scale
- Plants were weighed using Acculab Vicon Model VIC-123 Electronic Precision Scale
- Plants were measured in length from the horticultural rockwool growing medium base line with a stainless steel 30 cm measuring ruler
- Random Event Generator Psyleron REG-1 was used to monitor possible effects of human intention on physical system

Prior to the research study date, each of the eight HGC Practitioners met individually with the PI to:

- Test and record coherence levels (See Appendix E)
- Read and sign an informed consent form (See Appendix A)

- Obtain directions to the home of the PI
- Be given a general oral overview of the HGC practitioner's role in the study
- Receive answers to any questions that may have arisen

A high level of coherence was required to be achieved in order to be accepted into the study in the role of HGC practitioner. Each HGC practitioner was tested on coherence level using the Em-Wave® PC heart rhythm monitor. The date, average heart rate, and percentage scores for high, medium and low coherence for each practitioner are found in Appendix E.

Between Intervention Session #1 and Intervention Session #2, there was a recess period in which each HGC practitioner was tested on coherence level using the Em-Wave® PC heart rhythm monitor. The date, average heart rate, and percentage scores for high, medium and low coherence for each practitioner are found in Appendix F.

Each HGC practitioner was given two short surveys pre-intervention and post-intervention. Results from the Participant Pre-Survey are found in Appendix G. Results from the Participant Post-Survey are found in Appendix H.

Data Analysis

The study used a quantitative research design that included randomization, control and manipulation.

The direct hypotheses of the experiment were:

1. Heart-Generated Coherence (HGC) has a positive effect on water used to hydrate wheat seeds, resulting in the increased growth rate of wheat plants, as measured by plant weight and length.

2. Intention added to HGC has a positive effect on water used to hydrate wheat seeds, resulting in the increased growth rate of wheat plants, as measured by plant weight and length.

The null hypotheses were:

1. HGC has no effect on water used to hydrate wheat seeds, resulting in no increased growth rate of wheat plants.

2. Intention added to HGC has no effect on water used to hydrate wheat seeds, resulting in no increased growth rate of wheat plants.

Descriptive statistics were run for pre-measurement and post-measurement calculations for seed weight, plant weight and plant length and mean scores were calculated for Plant Groups (PG-A), (PG-B) and (PG-C.) Results were compared using a 3 x 2 mixed design analysis of variance (ANOVA) for weight, with one between groups factor, i.e. interventions vs. control, and one within groups factor, i.e. repeated measures pre-measurement and post-measurement. A one-way analysis of variance was used for plant length, as there was no pre-measurement.

Growth ratios for Plant Groups A, B and C were calculated according to seed weight, plant weight and plant length. Mean scores for Plant Groups A, B and C, were calculated in relation to growth ratios. The results, after a sixteen-day measurement interval, showed no significant variance in growth rate between Plant Group A (PG-A) (Intervention #1), Plant Group B (PG-B) (Intervention #2) and Plant Group C (PG-C) (Control Group).

The F ratio is used to determine differences, measuring the variability between the means of two or more groups and shows statistical significance if $p<.05$. Analyses of data indicated:

- No statistical significance for comparison of pre-measurement post-measurement seed and plant mean weights for Plant Groups with calculated p value of .437. (See Figures 4 and 5 and Tables 1 and 2 for statistical detail).

- No statistical significance for post-measurement mean lengths of Plant Groups with calculated p value of .409. (See Figures 6 and 7 and Tables 3, 4 and 5 for statistical detail).

A discussion of the research findings and suggestions for further study are found in Chapter 5.

Figure 4 shows the profile plots of Plant Groups A, B and C indicating no statistical significance in differential change in mean weight over time. (F= .832, p>.05) with df (2:157).

Profile Plots

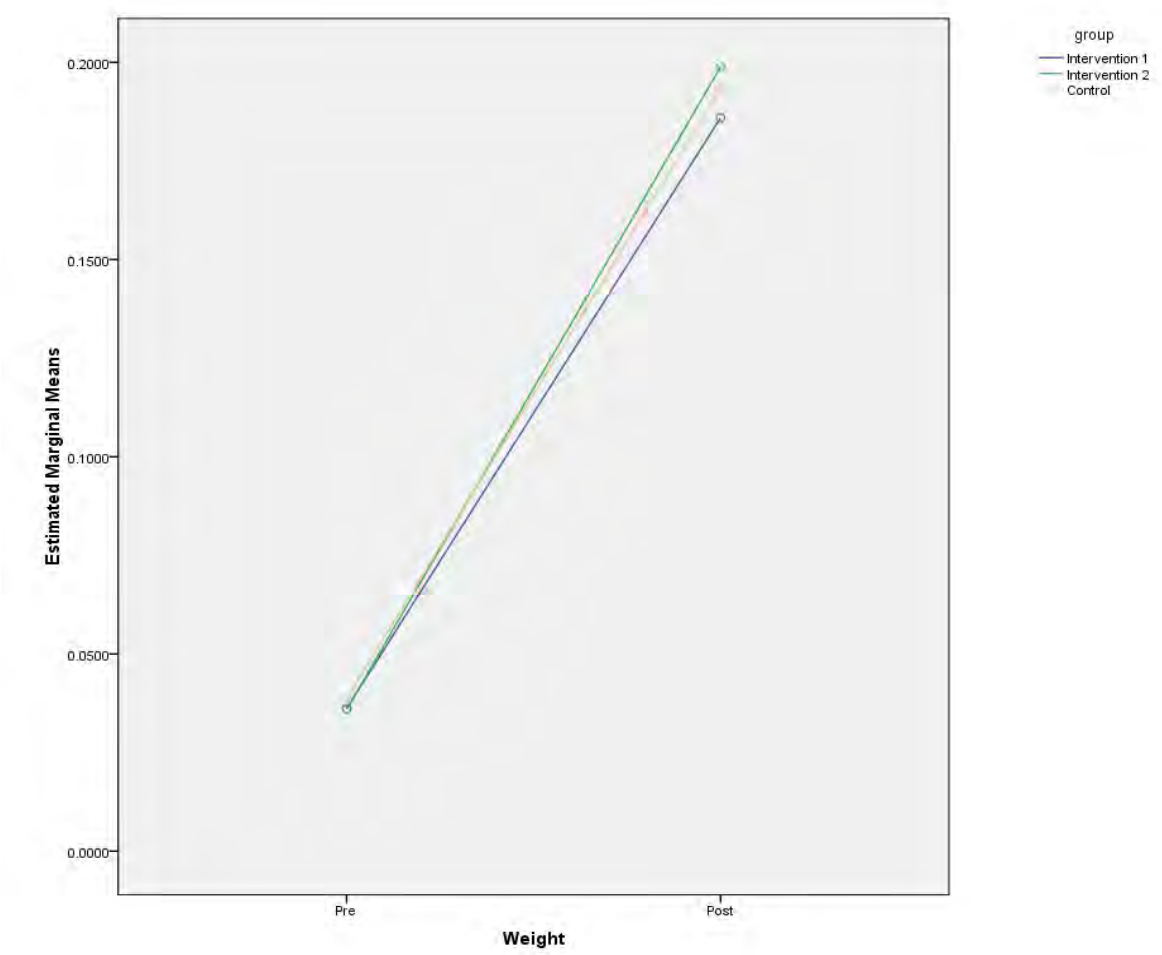

Figure 4. Pre-measurement post-measurement difference in weight between groups.

Differential change in Mean Weight over time was not significant (p>.05).

Legend:
Blue – Plant Group A (Intervention #1)
Green – Plant Group B (Intervention #2)
Tan – Plant Group C (Control Group)

Sphericity is a mathematical assumption referring to equality of variances of differences.
Greenhouse-Geisser is an adjustment made to degrees of freedom (df) to produce a more accurate significant value, if needed.
Huynh-Feldt is a correction of data collected at different times for each sample, if needed.
Lower-bound refers to F< or = all elements of subset.

Source		Type III Sum of Squares	df	Mean Square
Weight	Sphericity Assumed	1.965	1	1.965
	Greenhouse-Geisser	1.965	1.000	1.965
	Huynh-Feldt	1.965	1.000	1.965
	Lower-bound	1.965	1.000	1.965
Weight * group	Sphericity Assumed	.002	2	.001
	Greenhouse-Geisser	.002	2.000	.001
	Huynh-Feldt	.002	2.000	.001
	Lower-bound	.002	2.000	.001
Error(Weight)	Sphericity Assumed	.226	159	.001
	Greenhouse-Geisser	.226	159.000	.001
	Huynh-Feldt	.226	159.000	.001
	Lower-bound	.226	159.000	.001

Source		F	Sig.
Weight	Sphericity Assumed	1384.142	.000
	Greenhouse-Geisser	1384.142	.000
	Huynh-Feldt	1384.142	.000
	Lower-bound	1384.142	.000
Weight * group	Sphericity Assumed	.832	.437
	Greenhouse-Geisser	.832	.437
	Huynh-Feldt	.832	.437
	Lower-bound	.832	.437

Table 1. Plant group weight variances over time.

Differential change in mean weight was not significant over time (p>.05).

Multiple Comparisons

MEASURE_1

LSD

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intervention 1	Intervention 2	-.006324	.0061954	.309	-.018560	.005912
	Control	-.004889	.0061954	.431	-.017125	.007347
Intervention 2	Intervention 1	.006324	.0061954	.309	-.005912	.018560
	Control	.001435	.0061954	.817	-.010801	.013671
Control	Intervention 1	.004889	.0061954	.431	-.007347	.017125
	Intervention 2	-.001435	.0061954	.817	-.013671	.010801

Based on observed means.

The error term is Mean Square(Error) = .001.

Table 2. Statistical analysis of mean difference between groups

No statistically significant variance in weight was found between Plant Groups A, B and C ($p>.05$).

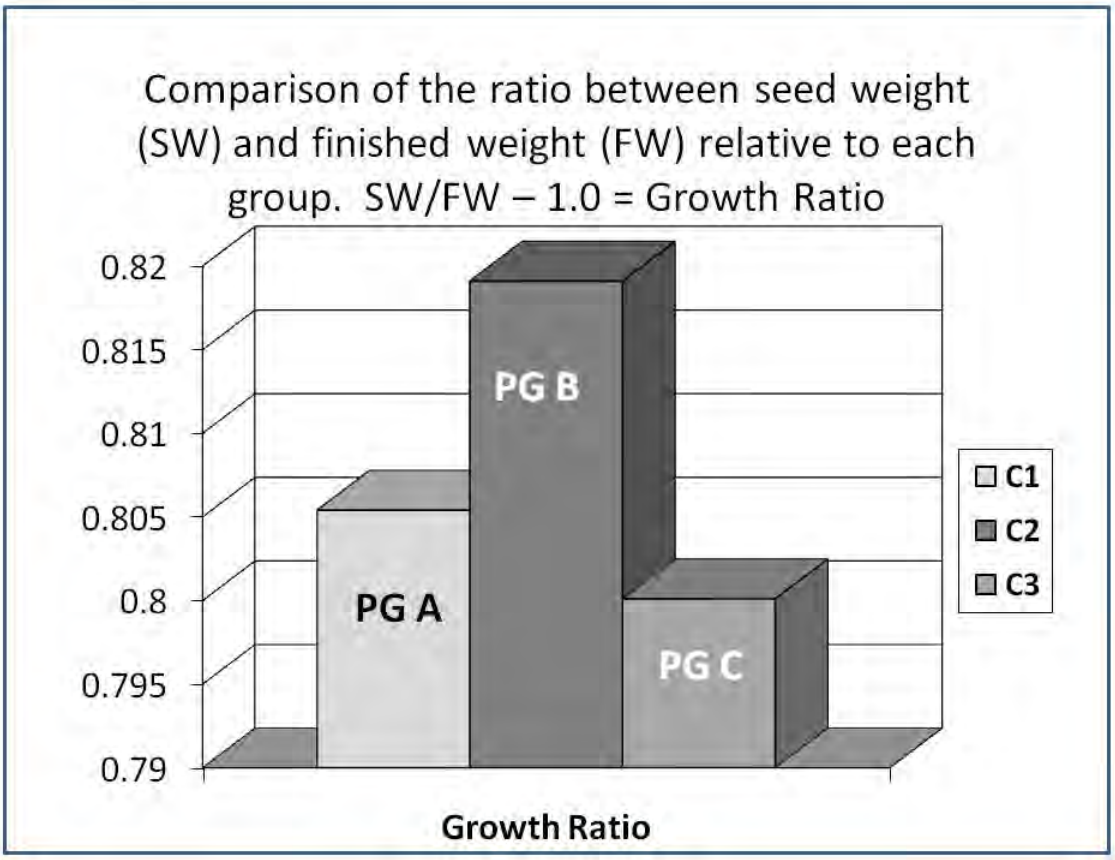

Figure 5. Comparison of growth ratio between seed weight and finished weight.

Growth ratio was calculated using seed weight pre-measurement and plant weight post-measurement.
Finished Weight (FW) was divided by Seed Weight (SW) - 1.0 = Growth Ratio.

Plant Group A (PG-A) Intervention #1 = .8054 gm.
Plant Group B (PG-B) Intervention #2 = .8191 gm.
Plant Group C (PG-C) Control Group = .8001 gm.

Plant Group B (PG-B) had the largest total growth ratio, however the deviation was not large enough to be statistically significant ($p>.05$).

Figure 6 shows a post-measurement comparison of mean lengths between groups.

Means Plots

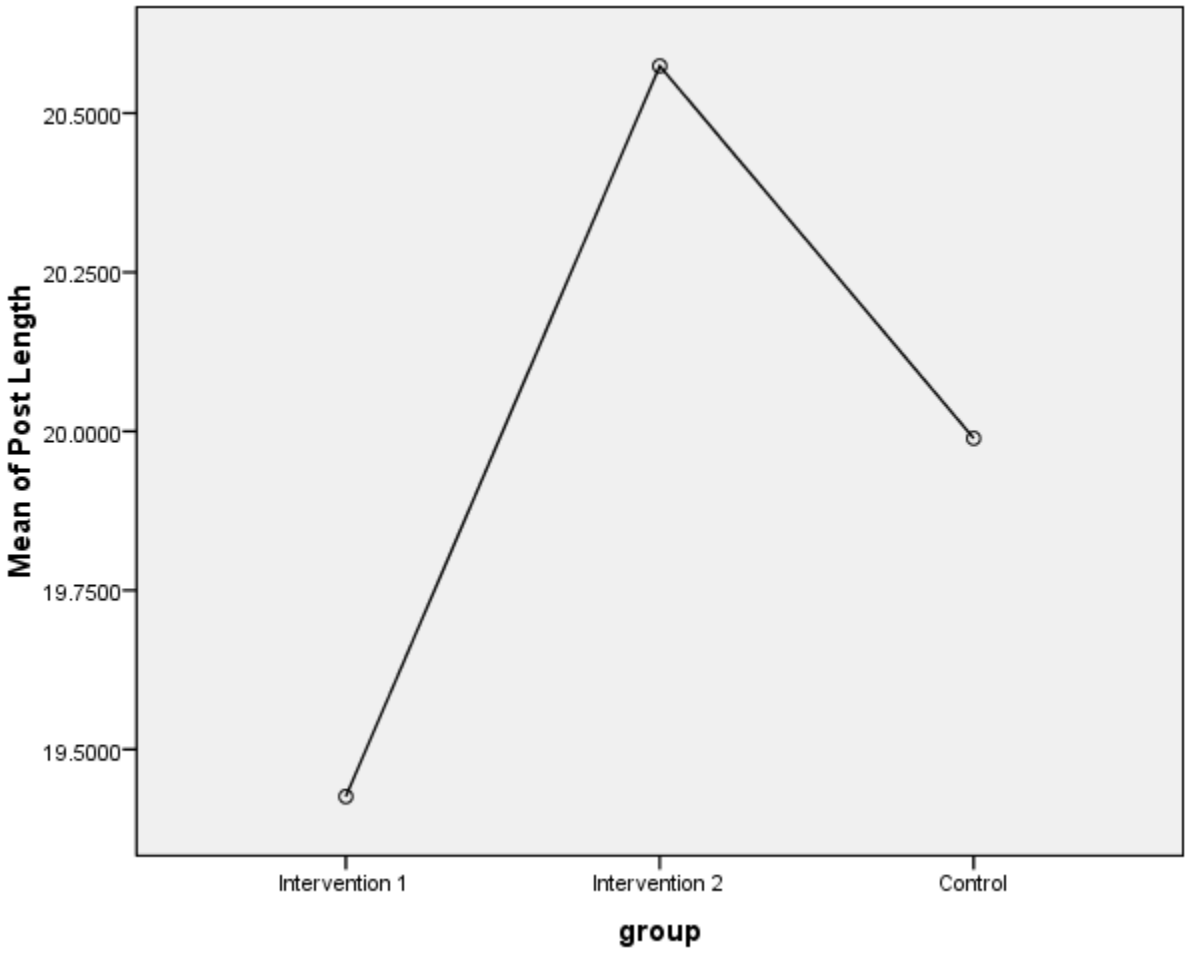

Figure 6. Average length mean scores for each plant group (cm)

Plant Group A (Intervention #1): 19.42
Plant Group B (Intervention #2): 20.57
Plant Group C (Control Group): 19.98

No statistically significant variance in post-measurement mean length was found between

Plant Groups A, B and C ($F=.899$, $p>.05$).

Descriptives

Post Length

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Intervention 1	54	19.425926	4.9254512	.6702690	18.081537	20.770315
Intervention 2	54	20.574074	3.1248961	.4252445	19.721142	21.427007
Control	54	19.988889	5.0362710	.6853497	18.614252	21.363526
Total	162	19.996296	4.4465199	.3493516	19.306394	20.686199

Descriptives

Post Length

	Minimum	Maximum
Intervention 1	.0000	26.0000
Intervention 2	11.6000	25.5000
Control	.0000	24.5000
Total	.0000	26.0000

Table 3. Descriptive statistics for length at post-measurement.

ANOVA

Post Length

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	35.597	2	17.799	.899	.409
Within Groups	3147.621	159	19.796		
Total	3183.218	161			

Table 4. Results of one-way ANOVA.

F=.899, p= .409

Multiple Comparisons

Post Length

LSD

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intervention 1	Intervention 2	-1.1481481	.8562701	.182	-2.839278	.542982
	Control	-.5629630	.8562701	.512	-2.254093	1.128167

Table 5. Statistical analysis of mean difference between groups

No statistically significant variance in post-measurement mean length was found between Plant Groups A, B and C ($F=.899$, $p>.05$).

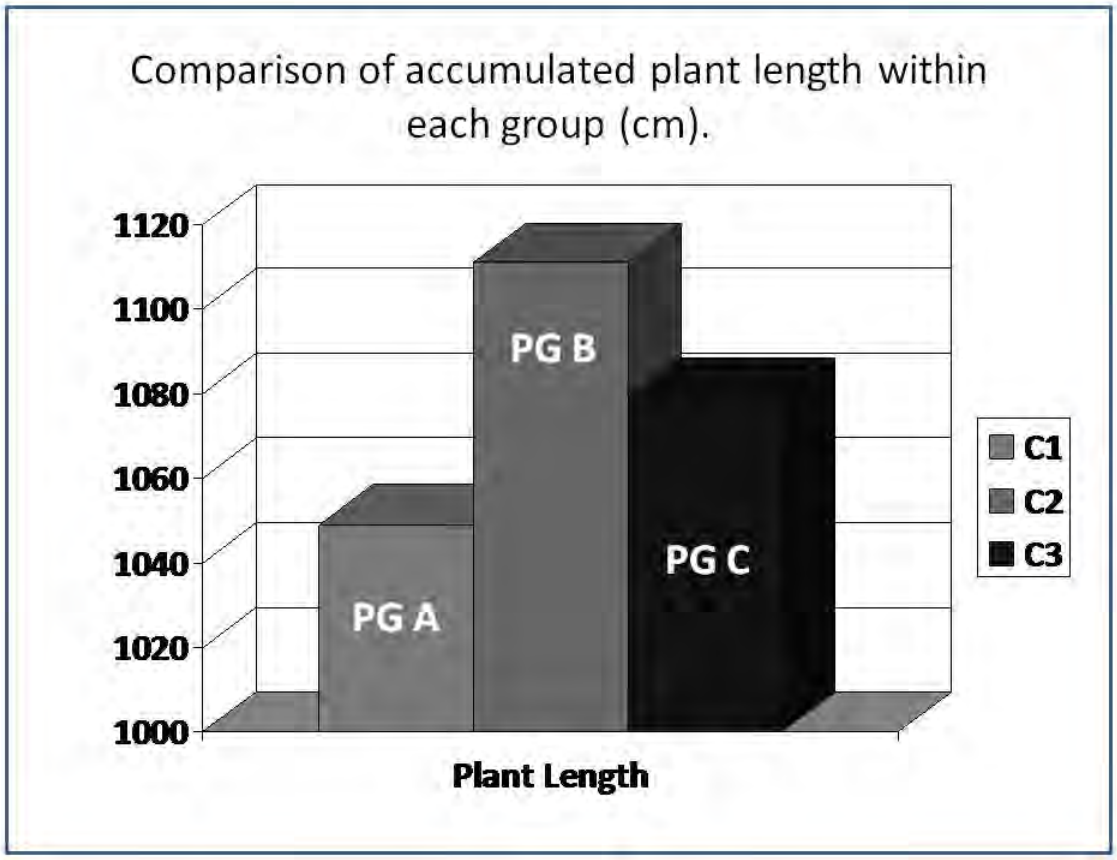

Figure 7. Comparison of post-measurement lengths between Plant Groups A, B and C.

Plant Group A (PG-A) Intervention #1 Post Length 1049 cm.
Plant Group B (PG-B) Intervention #2 Post Length 1111 cm.
Plant Group C (PG-C) Control Group Post Length 1079.4 cm.

Plant Group B (PG-B) had the largest total growth length, however the mean deviation was not large enough to be statistically significant ($p>.05$).

Figure 8. REG Data: October 10, 2009 12:00 noon to 5:00 p.m.

This graph indicates the relative balance of highs and lows over time and indicates their likelihood of accuracy by chance. The straight horizontal line across the middle is the theoretical expectation line. The upper and lower lines are thresholds of statistical significance.

During this study, the Random Event Generator was activated from 12:00 noon to 5:00 p.m. on October 10, 2009. Intervention Session #1 occurred between 1:15 p.m. and 1:35 p.m. with a correlated spike in the data between 1:10 p.m. and 1:35 p.m. Intervention Session #2 occurred between 2:21 p.m. to 2:41 p.m. with no anomaly recorded in the data during that time period.

There is no clear understanding of how a REG's random behavior can be altered by human interactions and interpretation is speculative. However, the research seems to support the hypothesis that coherent "group consciousness" can influence the REG even without specific intentions. These findings would suggest that the HGC practitioner group coherence during Intervention #1 affected the random output of the REG.

With the introduction of a specific intention in Intervention #2, the REG did not seem to be affected. This brings up the question as to why the first intervention appeared to affect the REG but the second intervention did not. It is possible that the introduction and repetition of the specific intention caused the HGC practitioners to concentrate less on the heart and more on the words, which then took them out of the heart-generated coherent state.

CHAPTER 5:
CONCLUSIONS, DISCUSSION AND SUGGESTIONS

Summary

The purpose of this study was to further the understanding of heart-generated coherence and positive directed intention by examining each of their effects on water, using plant growth as a measure. This chapter summarizes the findings of the study, including limitations and delimitations with suggestions for future research. The results of this research do not support the proposed directional hypotheses:

1. Heart-Generated Coherence (HGC) has a positive effect on water used to hydrate wheat seeds, resulting in the increased growth rate of wheat plants, as measured by plant weight and length.

2. Intention added to HGC has a positive effect on water used to hydrate wheat seeds, resulting in the increased growth rate of wheat plants, as measured by plant weight and length.

It is important to address alternative hypotheses that could account for the results of this research.

Discussion

There are several possible reasons for the lack of statistical significance in the scores of the two intervention groups. The first possibility is that the growing period was too short to allow for sufficient growth to occur. The trend in Figure 4 shows a slight

increase in growth rate for Plant Group B (Intervention Group #2) that, over time, might have achieved statistical significance.

The second factor to consider is the reduction of sufficient sunlight for Plant Group A (PG-A) due to positioning in the greenhouse. While Plant Group B (PG-B) and Plant Group C (PG-C) had uniform amounts of sunlight, the positioning of Tray #1 (T-1) containing Plant Group A (PG-A) was shaded due to the proximity of a window blockage in the greenhouse design. The blockage caused a 3-4 hour reduction in sunlight per day for PG-A. It is possible that the lack of sunlight may have been a factor in the reduced growth rate.

The third potential factor in the results of the study is the question of coherence levels sustained during the interventions. Although all HCG practitioners attained a high coherence level prior to being accepted into the study, since no HCG practitioner was monitored during either intervention, levels attained during intervention sessions are unknown. The results of the REG-1 Random Event Generator suggest that coherence may have been achieved during Intervention Session #1, but no anomalies were calculated during Intervention #2. Testing done between interventions indicated that two of the eight HCG practitioners had lower coherence scores. (See Appendix F) Stress may have been a factor. When answering the Participant Pre-Survey question, "How stressful would you rate your recent life?," two of the HGC practitioners replied, "Somewhat Stressful" and two replied, "Very Stressful." Life stressors and possible stress resulting from concern with being successful in the role as HCG practitioner, along with a lack of detachment from the outcome of the study, may have contributed to the lower scores.

A fourth consideration is the role of belief. As discussed in the Review of Literature (Chapter 2), previous studies indicate the possibility that the practitioner's belief in his or her ability to successfully influence the water may have been a factor in level of ability. On the Participant Pre-Survey, HGC practitioners were asked to rate their belief in the HeartMath® technique's efficacy in influencing the water. Two of the eight HGC practitioners either did not agree with or were unsure of the likelihood of success. It is possible that lack of confidence in the intervention may have contributed to the results.

A fifth question is whether the HGC practitioners had empathy with each other as a group. Assessing the results from the Participant Post-Survey, when asked to rate the following statement: "I felt connected to the rest of the group during the process," two of the eight neither agreed nor disagreed. Empathy has been shown to enhance the effects of distant intentionality. If the group was unable to achieve and maintain a level of empathy, it might have affected the outcome.

The emotional state of the PI is a sixth consideration for this study. Feelings of stress, concern for the outcome and ambivalence in keeping the water hidden from the HCG practitioners during Intervention #1 may have affected group coherence levels.

Most of the bottles of distilled water utilized for the study were purchased at the same time. However, on the day of the intervention, the PI became concerned about having too small a sample and purchased 3 more gallons of water, one for each group. The bottles were similar in design with the others except for a different colored lid. The HGC practitioners noticed and commented on the difference. This may have been a distraction.

A final consideration is the specificity in the wording of the intention statement. It read, "We intend that this water support vigorous and healthy growth in wheat seedlings." Since the subjects of the study were seeds, not seedlings, a more accurate statement would read, "We intend that this water support vigorous and healthy growth in wheat seeds." It is also possible that a less specific written statement may have been more effective. In researching previous successful experiments, the intentions used were simply for the highest and best of the subject. It may be more effective in future studies to use less specific wording such as, "May that which is best for this plant growth be established."

Delimitations and Limitations

The delimitations for this study were as follows:

- The PI is a HeartMath® Qualified Instructor and due to this training, was able to test the participants for coherence levels prior to the intervention and instruct the HCG practitioners in the conducting of the intervention.
- The PI is a Unity minister and was acquainted with several members of Unity who were also trained as HeartMath® practitioners.
- The researcher was able to use her home and greenhouse for the purposes of the study.
- Seeds and plants are excellent subjects for research.

The limitations of this study were as follows:

- Only eight people, six female and two male, were available to be recruited to conduct the intervention. The intention was to have twelve to fifteen adults with a larger male to female ratio.
- During the intervention, the HGC practitioners were tested for coherence levels. The test room, although located in another part of the home of the PI, had high noise levels from conversation among the remaining HGC practitioners in the Break Room. This caused distraction in some of the HGC practitioners as they were being tested, which may have been a factor in affecting coherence levels.
- Although a greenhouse was constructed on the south end of the home of the PI for the purpose of providing equal sunlight to all three Plant Groups, the first intervention group (PG-A) was placed in a more shaded area due to window blockage and did not have equal availability of sunlight, receiving 3-4 hours less sunlight each day. This may account for growth rate slower than would otherwise been the case.
- Seeds were randomly assigned before weighing with the result that the control group weight average was higher that the two intervention groups.
- A second research assistant, hired to plant the seeds, harvest, weigh, measure and compare the plants, withdrew from the study on the day of the planting and this necessitated an increased role for the Research Assistant (RA). The RA's duties then included transporting containers of water post-intervention, weighing seeds, planting, monitoring growth and water levels, harvesting plants, photographing, weighing and measuring plants.

- The wheat plants were harvested, after a growth period of sixteen days, which may not have been long enough to see a possible statistically significant change in the intervention groups.
- The HGC practitioners may have been apprehensive in conducting the intervention, increasing their stress level, thereby failing to reach a high level of coherence during the intervention.

Suggestions for Future Research

Considerations for future research include the following suggestions:

- Hire a second research assistant trained in horticulture and specifically hydroponics, to plant seeds, photograph, weigh and measure plants, monitor growing conditions, pH and nutrient levels.
- Grow plants indoors using grow lights to assure equal light and control temperature.
- Use a longer growing period to determine if growth trends become statistically significant over time.
- Germinate seeds prior to planting and randomly assign successfully germinated plants.
- During monitoring of coherence levels between interventions, provide a testing room that is quiet and free from distractions.
- Monitor coherence levels during interventions.

- Have a longer training program for HGC practitioners in order to increase ability to remain in a high coherent state as well as to assist in creating a coherent and empathic relationship between all of the practitioners.
- Control for the possible confounding factor of the phenomenon of the "conditioning" of the lab, as seen in Tiller's experiments using an Intention-Imprinting Electronic Device. In Tiller's experiments, despite the use of a Faraday cage, "[each] aspect of the physical space appeared to be in some sort of rhythmic, energetic harmony."[151] Although this effect appears to be created over time, and to control for this effect, both interventions were conducted in different rooms, it may have been a factor in the results between Intervention Session #1 (PG-A) and Intervention Session #2 (PG-2). Future research might be conducted in a building with larger space between intervention rooms.
- Use a larger sample of seeds in each group in order to obtain more robust results.
- Use water all purchased at the same time with uniformity of bottle design and color.

Conclusion

"Within me is the unborn possibility of limitless living; mine is the privilege of giving birth to it." Eric Butterworth

As mentioned in Chapter 1, this study examined the biologic effects of the interventions of heart-generated coherence (HGC) and focused intention on distilled

water using plant growth as an objective measure. Although the results did not support the directional hypotheses, further study is warranted.

There is a need for carefully controlled experimental research to continue to explore the power of the heart. As discussed in the Review of Literature in Chapter 2, much research has been done studying the influences of HGC and intention with affirmative and inspiring results. Evidence from this research indicates that encoded within the heart is a key to rich inner resources and secrets just waiting to be revealed. The possibility of positive effects on both human and non-human subjects calls for continued investigation. Further inquiry and exploration is recommended, taking into consideration the suggestions for future research as indicated.

As Rollin McCraty writes, "Acting as a synchronizing force in the body, a key carrier of emotional information and an apparent mediator of a type of subtle electromagnetic communication between people, the cardiac bioelectromagnetic field may have much to teach us about the inner dynamics of health and disease as well as our interactions with others."[152]

May the mysteries of the heart lead us to the depths of humanity's inherent wholeness that lies within.

APPENDIX A
Informed Consent Form

Holos University Graduate Seminary (HU) supports the practice of protection for human participants aiding in research. The following information is provided so that you may decide whether you wish to participate in the present study conducted by graduate student, Rev. Jane Simmons. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

This study is entitled, "The Biologic Effects of the Interventions of Heart-Generated Coherence and Focused Intention on Distilled Water Using Plant Growth as an Objective Measure."

The intervention you are being invited to participate in will consist of two 20-minute sessions. During the two sessions, focused intention and HeartMath® techniques will be practiced. The goal of the process is to ascertain the effects (if any) of these practices on water as measured by plant growth. One Heart Rate Variability (HRV) test will be administered prior to being accepted in to the study, a questionnaire pre-intervention, a questionnaire post-intervention and second HRV test will be administered after completion of the intervention. HRV data will be measured through a pulse wave recording device (EmWave PC®).

This is a doctoral dissertation research project facilitated by a HU student. Your participation is solicited although strictly voluntary. All information disclosed during this research will be held in confidence and will not be shared without your written consent. Your name will not be associated in any way with the research findings.

If you have concerns or questions about your rights as a research participant, you may email Dr. Ann Nunley, Dean of Academics, at AcademicsDean@holosuniversity.org or call her at the phone number listed below.

Sincerely,

Rev. Jane Simmons
Principal Investigator
1016 SW Lakeview Blvd
Lees Summit, MO 64081
816-600-2338

Dr. Ann Nunley
Dissertation Committee Chair
4222 Nunley Lane
McLouth, KS 66054
785-863-2176

I, the undersigned have read the above and agree to participate in this doctoral dissertation research study.

_____ _____
Signature Date

With my consent, I affirm that I am at least 18 years of age and have received a copy of the consent form to keep.

APPENDIX B
Participant Pre-Survey

Name _____ Date _____

1. How stressful would you rate your recent life? *(Please check (✓) only one.)*

   - ❍ 1 **Extremely Stressful**
   - ❍ 2 **Very Stressful**
   - ❍ 3 **Somewhat Stressful**
   - ❍ 4 **Not very Stressful**
   - ❍ 5 **Not stressful at all**

2. Given your experience with HeartMath®, how satisfied are you with the HeartMath® process in reducing stress? *(Please check (✓) only one.)*

   - ❍ 1 **Very Satisfied**
   - ❍ 2 **Satisfied**
   - ❍ 3 **Neither satisfied or dissatisfied**
   - ❍ 4 **dissatisfied**
   - ❍ 5 **Very Dissatisfied**

3. Of the following statements, which do you agree with?
   (Please check (✓) all that apply.)

   - ❍ 1 **I believe that the HeartMath® process can affect the water.**
   - ❍ 2 **I believe that it takes the group in coherence, not individual coherence, to affect the water.**
   - ❍ 3 **I believe that appreciation, outside of the HeartMath® process, can affect the water.**

4. Please specify what you do, if anything, for relaxation or meditation outside of the HeartMath® process to reduce stress. Please include the activity and the frequency.

_____
_____
_____

APPENDIX C
Participant Post-Survey

Name _____ Date _____

Please indicate how strongly you agree with the following statements. Please indicate whether you strongly disagree, disagree, neither agree or disagree, agree or strongly agree. *(Please check (✓) one per row.)*

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	
a. I felt enthusiastic and centered during the process	❍1	❍2	❍3	❍4	❍5	
b. I found it easy to stay concentrated during the process	❍1	❍2	❍3	❍4	❍5	
c. I felt connected to the rest of the group during the process	❍1	❍2	❍3	❍4	❍5	
d. I feel confident that through HeartMath®, we were able to affect the water	❍1	❍2	❍3	❍4	❍5	
e. I feel very relaxed . . . more than usual	❍1	❍2	❍3	❍4	❍5	
f. After the process, I still feel connected to the group through coherence	❍1	❍2	❍3	❍4	❍5	

APPENDIX D Seed and Plant Measurements

Metrics are in grams and centimeters
Seeds were planted 2.5 cm deep and harvested at the surface level of growth medium
Post length measurement does not include seed depth

Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight
82	.030	19.4	.168	107	.042	14.5	.158	87	.047	26	.277
145	.046	24.3	.239	9	.021	19.5	.175	49	.045	22.2	.221
161	.033	16.9	.15	159	.045	25.3	.245	118	.041	19.4	.173
92	.033	18.1	.162	136	.050	24.2	.265	94	.022	11	.09
13	.017	13.9	.088	22	.022	17.7	.156	12	.027	21.5	.194
148	.036	21.3	.225	154	.032	17.7	.158	115	.045	16.3	.156
98	.026	19.2	.103	85	.043	21.2	.207	95	.053	21.4	.216
33	.034	20.3	.177	142	.050	23.3	.24	41	.035	19	.198
43	.023	20.2	.183	52	.048	19.7	.206	110	.020	10	.06

Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight
3	.044	23.4	.284	16	.038	24.7	.267	89	.057	24.2	.279
91	.038	23.3	.224	139	.033	21.3	.209	104	.041	21.5	.217
101	.033	19.6	.158	157	.042	11.8	.094	130	.049	7.6	.073
90	.025	13.2	.119	39	.026	23.9	.224	6	.026	19.1	.157
46	.026	15.6	.14	93	.027	21	.177	36	.028	21	.204
133	.053	25.2	.291	151	.049	21.4	.241	127	.040	20.4	.199
25	.015	16.6	.119	86	.043	23.7	.268	84	.040	17.4	.165
124	.030	0	0	88	.042	26	.25	19	.029	19.6	.017
83	.042	18	.185	30	.027	23.8	.228	121	.045	22.2	.209
Totals			Pre-Weight 1.954			Post Length 1049			Post Weight 10.041		

Table 6. Tray 1 Plant Group A (PG-A).

Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight
5	.041	19.3	.18	40	.035	16.5	.135	112	.047	16.1	.175
100	.039	21.5	.199	120	.039	24.2	.227	144	.036	22	.224
114	.047	25.1	.274	123	.040	18.8	.186	153	.037	22.4	.211
48	.051	22	.247	106	.028	16.9	.153	2	.023	19.2	.151
23	.026	18.1	.161	66	.031	20.2	.201	26	.029	22.6	.198
117	.036	20	.184	11	.018	20.5	.169	51	.037	20.7	.19
62	.031	20	.163	31	.024	20	.189	64	.044	24.4	.243
103	.028	20.5	.168	56	.024	16.5	.143	60	.045	24.9	.242
58	.038	16.9	.151	132	.047	21.7	.237	162	.041	23.5	.224

Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight
37	.029	21.8	.207	63	.038	23.7	.264	34	.029	21.6	.233
20	.044	21.5	.216	138	.037	22.8	.227	150	.051	22.9	.0264
109	.034	20	.197	141	.030	19	.163	54	.028	22.5	.188
97	.038	18.5	.174	135	.055	24.9	.269	160	.036	11.6	.072
55	.030	20.3	.192	8	.025	19.3	.177	65	.040	25.3	.283
123	.021	16.5	.149	28	.040	22	.247	156	.051	25	.279
14	.015	18.6	.147	45	.035	21.3	.207	57	.033	19	.18
61	.046	18.2	.175	59	.057	25.5	.306	158	.047	25.5	.291
129	.033	19.4	.179	147	.032	12.5	.078	17	.026	17.3	.147

Totals Pre-Weight 1.942 Post Length 1111 Post Weight 10.736

Table 7. Tray 2 Plant Group B (PG-B).

Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight
80	.038	20.8	.196	72	.046	20.8	.227	68	.048	22.8	.235
152	.046	23	.246	15	.028	21.3	.193	131	.049	22.7	.229
18	.042	4.1	.014	143	.046	23.4	.242	42	.024	16.8	.145
149	.036	22.3	.193	78	.045	23.6	.241	96	.031	21.6	.201
50	.026	18.5	.143	102	.040	19.8	.189	4	.022	0	0
146	.050	24.4	.294	140	.043	24.1	.223	128	.044	23.2	.255
35	.040	24.5	.288	29	.034	23.7	.233	81	.031	22	.187
71	.040	15.7	.15	137	.051	17.1	.166	47	.044	24	.231
155	.049	22.5	.241	53	.057	10.5	.125	75	.033	21.3	.168

Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight	Ref #	Seed weight	Blade length	Blade weight
119.	.043	23	.225	69	.042	21	.195	67	.036	21	.191
24	.029	20.3	.187	21	.043	23.5	.266	105	.063	23.3	.3
125	.026	18	.147	113	.040	21.3	.219	79	.037	24.5	.236
7	.025	19.6	.161	77	.027	15.2	.129	99	.027	21	.162
122	.053	24.1	.244	38	.023	17.5	.145	1	.032	22.7	.218
74	.043	22	.227	76	.035	21	.186	108	.036	22	.206
70	.031	18.5	.159	10	.029	16	.125	27	.041	19.5	.18
44	.042	23	.261	111	.031	18.7	.145	32	.035	5.5	.032
134	.051	24	.273	116	.045	16.7	.132	73	.038	22	.231

Totals Pre-Weight 2.086 Post Length 1079.4 Post Weight 10.437

Table 8. Tray 3 Plant Group Control (PG-C).

Comparing ratio between the seed weight (SW) and finished weight (FW). SW/FW - 1.0 = Growth Ratio.
PG-A (Intervention #1) = .8054
PG-B (Intervention #2) = .8191
PG-C (Control Group) = .8001

APPENDIX E HGC Practitioner Coherence Level Scores

Prior to the research study date, each HGC practitioner was tested on coherence level using the Em-Wave® PC. The date, average heart rate, and percentage scores for high, medium and low coherence for each practitioner were as follows:

	Date	Avg Heart Rate	% High	% Med	% Low
Practitioner #1 (P1)	10/6/09	72	78	17	6
Practitioner #2 (P2)	10/7/09	67	100	0	0
Practitioner #3 (P3)	10/6/09	69	17	67	17
Practitioner #4 (P4)	10/8/09	65	83	17	0
Practitioner #5 (P5)	10/6/09	68	100	0	0
Practitioner #6 (P6)	10/8/09	79	50	50	0
Practitioner #7 (P7)	10/6/09	73	100	0	0
Practitioner #8 (P8)	10/7/09	88	100	0	0

Percentage scores are rounded to the nearest whole number resulting in a possible combined total of 101%.

APPENDIX F HGC Practitioner Coherence Level Scores

Between Intervention #1 and Intervention #2 was a recess period in which each HGC practitioner was tested on coherence level using the Em-Wave® PC. The date, average heart rate, and percentage scores for high, medium and low coherence for each practitioner were as follows:

	Date	Avg Heart Rate	% High	% Med	% Low
Practitioner #1 (P1)	10/10/09	73	63	29	6
Practitioner #2 (P2)	10/10/09	63	92	0	8
Practitioner #3 (P3)	10/10/09	63	88	13	0
Practitioner #4 (P4)	10/10/09	68	100	0	0
Practitioner #5 (P5)	10/10/09	79	50	50	0
Practitioner #6 (P6)	10/10/09	68	71	18	12
Practitioner #7 (P7)	10/10/09	68	20	80	0
Practitioner #8 (P8)	10/10/09	98	0	89	11

Percentage scores are rounded to the nearest whole number resulting in a possible combined total of 101%.

APPENDIX G Pre-Intervention Survey Results

The results of the pre-intervention survey were as follows:

- In answering the question, "How stressful would you rate your recent life?" four practitioners replied "Not very Stressful," two replied "Somewhat Stressful" and two replied "Very Stressful."
- In answering the question, "Given your experience with HeartMath®, how satisfied are you with the HeartMath® process in reducing stress?" all practitioners chose "Very Satisfied."
- In answering the question, "Of the following statements, which do you agree with? (Please check all that apply.)"
    - (1) I believe that the HeartMath® process can affect the water.
    - (2) I believe that it takes the group in coherence, not individual coherence, to affect the water.
    - (3) I believe that appreciation, outside of the HeartMath® process, can affect the water.

  Participants agreed with Statements (1), (2) and (3) as follows:

- Statement (1) – 5 agreed

  Statement (2) – 1 agreed

  Statement (3) – 5 agreed

  Two practitioners did not agree with any of the three statements or were unsure.

- In answering the question, “Please specify what you do, if anything, for relaxation or meditation outside of the HeartMath® process to reduce stress. Please include the activity and the frequency,” the practitioners answered as follows:
- (P1): Loving-kindness meditation – multiple times per day; prayer – multiple times per day
- (P2): Meditation – 5-7 times/week; Course in Miracles lessons daily; many different Unity related processes to assist in connection, truth, peace; music, gardening
- (P3): Walking in woods/nature – 1-2 times weekly; daily morning meditation and devotional reading; once weekly – art/music, theater event
- (P4): Prayer – daily; journaling – 3 times a week; for relaxation: watch movies once a week; read fiction every night before bed; walk the dog
- (P5): Listen to music; write; photography; sing; meditate; connect with friends; read; watch movies; shopping; museums; travel. Frequency: lately not all of these, at least one
- (P6): Bi-weekly 15-25 minute meditation; Daily – 2-5 minute meditation
- (P7): Exercise 2-5 times per week; meditation – daily; focused breathing – daily; prayer – daily
- (P8) did not list any activities or frequency

APPENDIX H Post-Intervention Survey Results

The practitioners were given a second survey, post-intervention, with a series of statements and were asked to indicate whether they strongly disagree, disagree, neither agree or disagree, agree or strongly agree with each statement. The results of the post-intervention questionnaire were as follows:

- For the statement, “I felt enthusiastic and centered during the process,” four agreed and four strongly agreed
- For the statement, “I found it easy to stay concentrated during the process,” five agreed and three strongly agreed
- For the statement, “I felt connected to the rest of the group during the process,” two neither agreed or disagreed, one agreed and five strongly agreed.
- For the statement, “I feel confident that through HeartMath® we were able to affect the water,” two neither agreed or disagreed and six strongly agreed
- For the statement, “I feel very relaxed…. more than usual,” one disagreed, four agreed and three strongly agreed
- For the statement, “After the process, I still feel connected to the group through coherence,” one neither agreed or disagreed, three agreed and four strongly agreed

APPENDIX I Figures 9-17

Figure 9. October 14, 2009 Plant Group A (PG-A) Intervention #1

Figure 10. October 14, 2009 Plant Group B (PG-B) Intervention #2

Figure 11. October 14, 2009 Plant Group C (PG-C) Control Group

Figure 12. October 19, 2009 Plant Group A (PG-A) Intervention #1

Figure 13. October 19, 2009 Plant Group B (PG-B) Intervention #2

Figure 14. October 19, 2009 Plant Group C (PG-C) Control Group

Figure 15. Sample of wheat plants Plant Group A (PG-A) Intervention #1 October 26, 2009

Figure 16. Sample of wheat plants Plant Group B (PG-B) Intervention #2 October 26, 2009

Figure 17. Sample of wheat plants Plant Group C (PG-C) Control Group October 26, 2009

APPENDIX J

PROTOCOL FOR EXPEDITED REVIEW OF RESEARCH

Holos University Graduate Seminary

Submitted by Rev. Jane Simmons

Title of Research: **A Study and Comparison of the Effects of Heart-Generated Coherence and Intention on Water as Measured by Plant Growth**

Background and Theoretical Framework: **This study will examine the biologic effects of the interventions of heart-generated coherence and focused intention on distilled water using plant growth as an objective measure.**

Webster defines the word coherence as "logical interconnection." Quantum science is now revealing the extent to which this logical interconnection truly exists. Heisenberg's uncertainty principle tells us that quantum particles are constantly fluctuating, giving rise to the Zero Point Field. This continuous interaction creates potential entanglement through quantum waves and "implies that all matter in the universe is connected on the subatomic level through a constant dance of quantum energy exchange."[153]

How might this dance be evident in the interactions between the power of human intention, the electromagnetic field of the heart, and the growth of plants? This research project will study the effects of both positive intention and coherence generated by the human heart on water utilized in the growth of plants.

Further Definitions of Coherence

The term, coherence, used in the realm of physics refers to "two or more waves that are phase- or frequency-locked together to produce a constructive waveform".[154] A laser beam is illustrative of this type of coherence. It is phase-locked to create a powerful coherent energy wave. In comparison, an incandescent light bulb emits diffused energy waves.

Mathematically speaking, coherence describes an ordered distribution of power within a waveform, as demonstrated in a sine wave, a frequency repeated over equal intervals of time. These resonant waves appear in the rhythms of the ocean, the reverberation of a tuning fork, as well as in auditory and electrical engineering fields.

Physiological coherence is defined as "…a state in which two or more of the body's oscillatory systems, such as respiration and heart rhythm patterns, become synchronous and operate at the same frequency."[155] In this study, coherence refers to resonance, synchronization and entrainment emerging from the harmonious effects of sustained positive emotions generated by the heart.

Viewing the difference between a laser beam and the suffused photons of a light bulb, it becomes evident that there is great strength and power in the linking of ordered magnetic energy. Sub-atomic coherent particles "stop behaving like anarchic individuals and begin operating like one well-rehearsed marching band."[156] This creates an effect known as "entrainment."

Entrainment

Entrainment is a phenomenon discovered by Dutch clockmaker Christian Huygens in 1665 as he witnessed pendulum clocks swinging in unison. It refers to increased coherence between systems, demonstrated when flocks of birds or schools of fish suddenly move together as one through a resonance of rhythmic vibration. Physiologically speaking, this state is created when two or more of the body's systems become synchronous, enhancing energy and efficiency in functioning. Indigenous cultures have long utilized the benefits of entrainment created through drumming. Neurologist Barry Bittman investigated the effects of group drumming on the alteration of stress-related hormones. His study measured positive effects in DHEA hormonal changes and other neuroimmunal responses.[157]

Certain types of music can also create entrainment in the body. Citing Mitchell Gaynor's book, *Sounds of Healing: A Physician Reveals the Therapeutic Power of Sound,* Holos University graduate, Dr. Debbie Pratt writes in her 2008 dissertation, "Entrainment occurs when the vibration of one object is projected upon a second object with a similar frequency, causing the second object to vibrate in resonance with the first…. Studies have shown that when instruments emit Extremely Low Frequency (ELF) sounds between four and eight cycles per second, they mirror the theta range of brain waves that occur during meditation, thus entraining the brain waves to these same frequencies."[158]

The same coherent movement can be self-generated within the body. The heart, the body's largest oscillator, can pull the other systems into entrainment with its harmonious efficiency when feelings of love and appreciation are sustained. Entrainment can occur at physical, mental and emotional levels within the human biological system. How far reaching can the effect of coherence be?

In a study of electroencephalogram (EEG) correlations between pairs of people, Dean Radin found that two people who were bonded (couples, parents and their children) displayed EEGs that appeared to synchronize. This indicates an energetic exchange that takes place between couples and in many instances results in an entrainment of brain waves.[159]

The synchronization occurs not only in brain waves, but also in cardiac signals. In a recent study by Jeanne Denney, patients in a comatose state, nearing death, had significant changes in their heart rhythm patterns that coincided with the heart patterns of their caregivers. These findings suggest that energetic communication occurs between patients and those who care for them even when there is no longer any verbal exchange.[160]

As well, in a study detecting and measuring cardiac energy exchange, researchers Rollin McCraty and William Tiller discovered evidence of an exchange of heart-generated electromagnetic energy as one person's electrocardiogram signal registered in

another's electroencephalogram.[161] The signal was strongest for people touching or in close proximity but was still detectable in people who were distanced from each other.

The above-mentioned studies suggest that there is a deeper energetic connection between people that can be accessed when in a state of coherence.

Role of the Heart

Studying the rate at which the heart beats can provide insights into the physiology of the body as the heart's rhythmic patterns change with emotions. A two-way system of communication between the heart and the brain helps to regulate heart rate, blood pressure and heart rate variability (HRV). HRV is a measure of the changes in heart rate as the heart speeds up and slows down and is affected by thoughts and emotions. Psychologists have found that monitoring HRV provides a map of the emotions as "thoughts, perceptions and emotional reactions are transmitted from the brain to the heart via [the sympathetic and parasympathetic] branches of the autonomic nervous system and can be seen in the patterns of your heart rhythms."[162]

Creating an ordered HRV pattern indicates cardiovascular efficiency. When this happens, the two branches of the nervous system move into a state of entrainment, working together.

In physiological terms, the sympathetic nervous system controls the "fight or flight" response during times of stress, with effects of sympathetic stimulation including dilation of the pupils, reduction in peristalsis, accelerated heart rate and blood pressure increase. The parasympathetic nervous system, on the other hand, gives the "rest and digest" response, which includes constriction of the pupils, decrease in heart rate and blood pressure. Measuring the HRV shows the balance (or imbalance) between these two systems, since one is used to slow the body down and the other to speed the body up. The study of HRV "is a powerful, objective and noninvasive tool to explore the dynamic interactions between physiological, mental, emotional and behavioral processes."[163]

Negative emotions are associated with disordered, incoherent patterns in heart rhythms, as measured through spectral analysis. Sustained positive emotions appear to give rise to a state of psycho-physiological coherence indicated by a smoother coherent pattern.

Emotional and Physiological Effects of Stress

In the Western lifestyle, the prevalence of stress seems to be an accepted part of life and yet the effects are extremely debilitating. Researcher Hans Selye defined stress as "the non-specific response of the body to any demand for change."[164] The fight or flight reactions to those things over which we have little or no control, cause what Selye termed "The Alarm Reaction."[165]

The reaction to stress in the body is a release of adrenaline into the bloodstream, which elevates heart rate, blood pressure, tenses muscles and speeds breathing. In short, it prepares us for fight or flight. Other hormones such as noradrenaline and cortisol (known as the stress hormone) are also released. When stress becomes a chronic state, it can be extremely damaging to the system.[166] According to the studies reported in the book, *The HeartMath Solution*[167], chronic high levels of stress can cause physiological

damage leading to heart disease. When the nervous system is out of balance, blood vessels constrict, there is a rise in blood pressure and energy is wasted. If this becomes a chronic state, hypertension may result.

The body's stress response encompasses over fourteen hundred physical and chemical reactions, as well as over thirty hormones and neurotransmitters.[168] A Duke University study showed that stress could affect blood supply to the heart. As well, chronically elevated levels of adrenaline and cortisol can affect immune function, causing bone and muscle density, impaired memory and increased fat accumulation.[169]

Effects of Positive Emotions

How does positive emotion affect physical, mental and emotional wellbeing of the body? Institute of HeartMath® "research shows that the …process of focusing attention in the area of the heart, while experiencing a positive feeling, changes the patterns of information flowing along this pathway [from heart to brain] to a more coherent and harmonious pattern."[170] By focusing on the heart and allowing feelings of love and appreciation to expand and radiate outward, our systems come into alignment and we create a coherent state in the body. This can produce a feeling of "amplified peace."[171]

Positive emotions increase production of the hormone DHEA. This hormone has been called the 'anti aging hormone' since it seems to decrease with age. Low levels of DHEA have been found to be a factor in many medical problems such as sleep disorders, diabetes, chronic fatigue, high cholesterol and depression. When the DHEA levels are high, cortisol levels lower, causing feelings of revitalization. In one study, participants lowered cortisol levels by 23% and increased DHEA by 100% through feelings of love and appreciation.[172]

Magnetic Field of the Heart

Ampere's Law states that electric currents produce magnetic fields. The magnetic field is created when an electric current runs through a conductor. In 1963, G. Baule and R. McFee measured the magnetic field of the heart generated by the heart muscle's electrical activity.[173] This energy field has been measured up to fifteen feet from the body although the increasing range of detection says more about the sensitivity of the measuring instruments than it does about the size of the field. According to James Oschman, "The biomagnetic field of the heart extends indefinitely into space. While its strength diminishes with distance, there is no point at which we can say the field ends."[174] Progress in instrumentation design has revealed the strength of the heart's magnetic field to be the most powerful in the body and research shows that cardio-electromagnetic communication can be generated through coherence building techniques.[175]

Three Steps to Coherence

There are three basic steps to creating coherence through HeartMath® techniques; shifting attention to the heart; breathing slowly and deeply; and generating a feeling of appreciation. Shifting the focus from the head to the heart helps to disengage from stressful thinking, and is the first step to getting "the mind out of the way so that

coherent, positive feelings are driving the process."[176] Integrating the shift in focus with attention to slow, deep breathing encourages the emergence of the entrainment pattern. The coherent pattern is maintained through the feelings of appreciation. These are simple steps and can be done by people of all ages in different settings. By practicing heart-focused breathing and sustaining feelings of appreciation and gratitude, the system comes into and maintains a state of coherence.

Conclusion

The intention of my study is to further the understanding of heart generated coherence by examining its effects on water, using plant growth as a marker. I will compare the effects of heart-generated coherence, both with and without positive intention, on water used to hydrate hydroponically grown plants. In addition, there will be a control group having no intervention. By measuring plant growth for all three groups, I intend to demonstrate differences in plant growth as an indicator of the effect, if any, of heart-generated coherence and answer the questions:

- What happens to the growth of plants when water used for their growth has been in close proximity to human heart-generated coherence?
- Is the effect changed in any way when adding intention to the protocol?

I believe the heart holds the key to rich inner resources and secrets just waiting to be revealed. I agree with Rollin McCraty when he writes, "Acting as a synchronizing force in the body, a key carrier of emotional information and an apparent mediator of a type of subtle electromagnetic communication between people, the cardiac bioelectromagnetic field may have much to teach us about the inner dynamics of health and disease as well as our interactions with others."[177]

Study Design: **The experimental design will be a pre-measurement/post-measurement with a control group.**

HeartMath® Practitioners: **8-12 men and women over 18**

Inclusion Criteria

All HeartMath® practitioners applying the intervention will meet the following inclusion criteria:

- Age restriction of 18 years of age or older
- Member of Unity church
- Willingness to participate in the study and sign a consent form
- In good health and not currently receiving medical care for any heart-related illness
- Trained in HeartMath® techniques and able to sustain a high level of coherence as measured, prior to acceptance into the study, by an EmWave PC® heart rhythm monitor feedback system

Exclusion Criteria

HeartMath® practitioners will be excluded who:

- Are currently receiving medical care for heart-related illness and/or using prescribed heart medications
- Are unable to sustain a high level of coherence as measured, prior to acceptance into the study, by an EmWave PC® heart rhythm monitor feedback system

List Potential Risks/Safety: **None**

Discontinuation Criteria for HeartMath® practitioners: **The two interventions will be done during the same day in a period of time divided into two parts**. **HeartMath® practitioners may withdraw prior to the session if a conflict arises.**

Measurements to be used: **Height and weight of plant growth**

Consent Form for HeartMath® practitioners: **Attached**

Protocol Monitoring:

Pre-Inclusion Screening

Testing: **The HeartMath® practitioners practicing the heart coherence techniques will be tested, prior to acceptance into the study, using the Em-Wave PC® heart rhythm monitor to determine attainment of a high level of coherence. The Em-Wave PC® monitors beat-by-beat changes in heart rate using an electronic ear sensor, analyzing the heart rhythm pattern. The scale of the heart rhythm graph is determined by time axis and heart rate axis settings. Time axis settings range from 5 to 60 seconds per division, with a default setting of 30 seconds; heart rate axis settings range from 2 to 20 beats per minute, with a default setting of 10 beats. The entrainment ratio bar chart records a continuously updated view of the user's entrainment ratio score of low, medium or high, reflecting average levels of entrainment reached during the user's monitoring session. "The coherent mode is reflected by a smooth, sine wave-like pattern in the heart rhythms (heart rhythm coherence) and a narrow-band high-amplitude peak in the low frequency range of the HRV power spectrum, at a frequency of about 0.1 hertz."[178] All HeartMath® practitioners will be required to attain and sustain a high level of entrainment in order to apply the intervention. In addition, post-intervention, each HeartMath® practitioner will be given a self-assessment questionnaire using a Likert scale to report any changes in feelings of wellbeing.**

Research Intervention:

Intervention Session #1

For Intervention Session #1 (IS-1), the HeartMath® practitioners will meet with the PI at a time to be determined in Training Room (T-R) for instruction and practice of the HeartMath® technique, Heart Lock-In. The HeartMath® practitioners will be instructed by the PI to begin practicing the HeartMath® Lock-In technique for twenty minutes while seated in a circle. The Heart Lock-In technique consists of three steps: shifting attention to the heart; breathing slowly and deeply; and generating a feeling of appreciation. Placed under a table at the center of the circle, but hidden from the group's immediate sight by a draped tablecloth, will be five 1-gallon containers of distilled water, each labeled (C-1). In order to preclude "intention" in this session, the HeartMath® practitioners will be unaware of the presence of the water and will be told, "The only activity in this session is practice of the Heart Lock-In technique." Water from (C-1) will be used to hydrate the wheat plants in Plant Group A (PG-A).

Following the 20-minute session, the HeartMath® practitioners will have a 20-minute break in Break Room (B-R). After completion of the intervention for (PG-A), the five 1-gallon containers of distilled water (C-1) will be removed, transported to a greenhouse, adjacent to the home of the PI, and tagged with color-coded labels by Research Assistant #1 (RA-1).

Intervention Session #2

For Intervention Session #2 (IS-2), the HeartMath® practitioners will meet with the PI in Intervention Room (I-R) following a 20-minute break in order to practice the HeartMath® Lock-In Technique, while generating intention for positive plant growth towards the water, for twenty minutes. Five 1-gallon containers of distilled water, each labeled (C-2) will be placed beneath the table at the center of the circle in plain view and HeartMath® practitioners will be aware of the presence of the water. The PI will read the following specific written intention aloud to the group and each participant will be asked to focus on the intention for twenty minutes while practicing the HeartMath® Lock-In technique. "We intend that this water support vigorous and healthy growth in wheat seedlings." Water from (C-2) will be used to hydrate the wheat plants in Plant Group B (PG-B). After completion of the intervention for (PG-B), the five 1-gallon containers of distilled water (C-2) will be removed, transported to the greenhouse, placed at a distance of three feet from containers (C-1) and tagged with color-coded labels by RA-1.

Control Group C

Five one-gallon containers of untreated distilled water (C-3) will be placed in the greenhouse at a distance of six feet from containers (C-1) and three feet from containers (C-2) and tagged with color-coded labels by RA-1. The water will be used to hydrate the control Plant Group C (PG-C) in a procedure identical to that used to hydrate the other plants by the same Research Assistant #2 (RA-2). Research Assistant #2 will match the color-coding of the water with that of the trays when watering the trays, but will be unaware of what the color codes signify.

Post Tests: **Instruments to be used during Data Collection**

Wheat seeds from each group will be weighed using an electronic scale (Mettler PM 100) before receiving the intervention. Wheat plants from each group will be weighed and measured post intervention to determine both rate of plant growth and length of root. Plants will be compared for overall quality and color.

Monitoring Personnel for Research:

Chair of Dissertation: **Dr. Ann Nunley**

List Primary Researcher and any assistants:

Primary Investigator: **Rev. Jane Simmons**

First Research Assistant: Rev. Dr. Gary Simmons
Second Research Assistant**: To be selected. The name will be included in the first quarterly report.**

Research Results: Analysis: **ANOVA, a mixed analysis of variance (ANOVA), analyses will be conducted to calculate the mean and standard deviation for the scores of each plant group to determine if significant variation exists in the results of the study plant groups.**

Confidentiality Statement: **Included in Consent Form**

Method of sharing results with research participants: **All HeartMath® practitioners will receive a written report of the research study findings.**

The PI will submit quarterly reports to the Institutional Review Board (IRB) plus a final report documenting the research study results.

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Notes

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