

INFRARED SPECTRA ALTERATION IN WATER PROXIMATE TO THE PALMS OF THERAPEUTIC PRACTITIONERS

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ABSTRACT

Through standard techniques of infrared spectrophotometry, sterile water samples in randomly selected sealed vials evidence alteration of infrared (IR) spectra after being proximate to the palms of the hands of both Practising and Non-practising Therapy Practitioners, each of whom employed a personal variation of the Laying-on-of-Hands/Therapeutic Touch processes. This pilot study presents 14 cases, involving 14 Practitioners and 14 Recipients. The first hypothesis, that a variation in the spectra of all (84) Treated spectra compared with all (57) control spectra would be observed in the 2.5 - 3.0 micrometer range, was confirmed ($p = 0.02$). Ten per cent (15) of the spectra were done using a germanium Internal Reflection Element (IRE). Ninety per cent of the spectra (126) were done with a zinc selenide IRE, and the difference in refractive index between the two IREs skews the data. The zinc selenide IRE spectra alone yield $p = .005$. The authors believe the most representative evidence for the effect appeared in the sample group of Treated vs. Calibration Controls using the zinc selenide IRE ($p = 0.0004$). The second hypothesis, that there existed a direct relationship between intensity of effect and time of exposure was not confirmed. This study replicates earlier findings under conditions of blindness, randomness, and several levels of controls. Environmental factors are considered as explanations for the observed IR spectrum alteration, including temperature, barometric pressure, and variations dependent on sampling order. They do not appear to explain the effect.

Keywords: *Infrared-spectra, therapeutic-intent, hydrogen-bonding, healing, water*

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Infrared Spectra Alteration in Water

Studies by researchers in a variety of disciplines notably biologist Bernard Grad at McGill University,¹ biochemist M. Justa Smith at Rosary Hill College and Roswell Park Cancer Hospital² physicist Elizabeth Rauscher at University of California, Berkeley,³ and psychologist Carroll Nash of St. Joseph's University⁴ report increased vitality in treated sub-populations of cell colonies, enzymes, and seedlings in comparison with controls. In each study treatment consisted of some variation of an historical technique known as Laying-on-of-Hands, or a modern nursing program known as Therapeutic Touch. Critics argue, however, that the high variability of living systems, rather than the independent variable of Therapeutic Intent being studied, may account for the positive results reported in such experiments. Work done by Grad using near-infrared spectrophotometry has suggested a possible avenue for research defensible against such criticisms.⁵ Dean and Brame continued that line of research, and their results supported Grad's findings.⁶

This earlier research suggests the existence of an objectively measurable infrared (IR) signature which is independent of measurements on living systems. However, the work has not been uniform in methodology or controls, making cross-study correlations and comparisons very difficult. Some of the work has also been subject to methodological criticism, i.e. how the bottles were filled, and whether tap water, used in several instances, could contain substances which might produce the effect. This pilot study incorporated such criticisms into its design to test the initial findings and, if they held up, to establish a database of sufficient size to guide future work.

The IR portion of the electromagnetic spectrum was selected for monitoring, based on the assumption that, although we do not know the mechanism, what we are observing is a change in the oxygen-hydrogen (O-H) bonding. The state of O-H bonding is best observed in the infrared where the fundamental stretching frequency occurs,⁷ although earlier research suggests that overtones and combinations of overtones of the phenomenon occur at higher frequencies up to the ultraviolet (UV) region.⁸ Because these UV bands are overtones, they are weaker and less clearly defined.

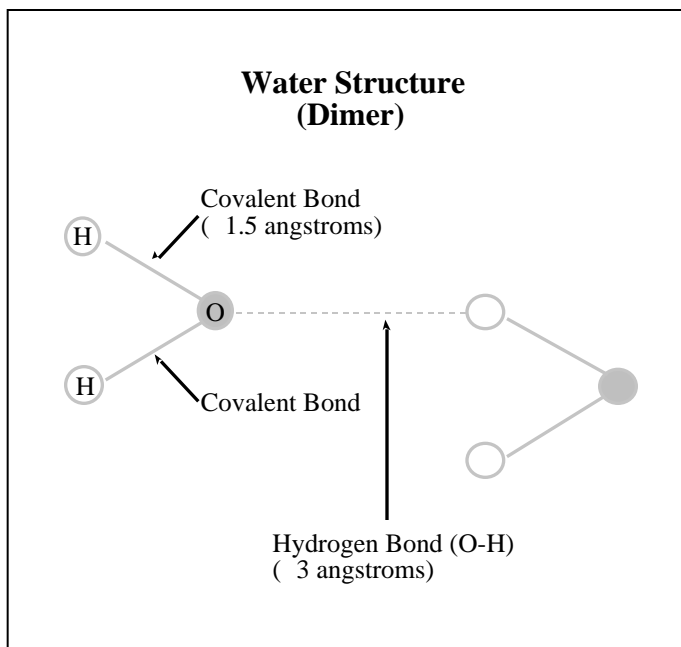
What exactly is the physical parameter being measured in these studies and what is known about the physics of the system giving rise to it? We provide a brief sketch of infrared spectroscopy and its use for determining the structure of water.

The Infrared is a region of the electromagnetic spectrum, or range of frequencies of electromagnetic oscillations. For any frequency of radiation there is a corresponding wavelength; shorter wavelengths correspond to higher frequencies. Frequency is usually measured in waves per centimeter (cm^{-1}) and wavelength in micrometers. The infrared portion of the spectrum extends from 2.0 micrometers (5000 wave numbers) to 16.0 micrometers (625 wave numbers). This experiment focused on the 2.5-4.0 micrometer range (4000-2500 wave numbers).

Substances absorb electromagnetic radiation at specific frequencies and these features of their spectra are called absorption bands. Such absorption of energy occurs when the frequency of the radiation coincides with the natural frequency of oscillation of

some part of the molecular structure of the substance. This is an example of resonance and the infrared is of particular interest because many chemical bonds have resonances, and hence absorption bands, in this region. For instance, the frequency of the fundamental stretching oscillation of the covalent bond between the oxygen and hydrogen atoms in a water molecule occurs in the infrared at a frequency of 3400 cm^{-1} .⁹

The covalent bond, however, is only one of two distinct types of chemical bonding present in water. So called hydrogen bonds also exist between molecules in close proximity. These hydrogen bonds, although much weaker than covalent bonds, still exert considerable influence on the properties of water at ambient temperatures and pressures when the thermal energy of the molecules is comparable to the hydrogen bond energy. (See Figure One)



A schematic of the water structure of two linked molecules, called a dimer. It is the Hydrogen Bond that is presumed to be affected.

Figure One

The fundamental stretching frequency of the O-H bond in water is particularly affected by the amount of hydrogen bonding and a considerable literature exists on the exact shape of this absorption band. Discussion of this subject though is carried out within the context of one or another of two broad classes of models of the structure of water: 1.) Mixture, and 2.) Continuum.¹⁰ In mixture models it is assumed that hydrogen bonding between single water molecules (monomers) groups them into dimers (two linked), trimers (three linked), and so on up to higher analogues. Thermal agitation causes breaking and reforming of the hydrogen bonds in these groups, and a dynamic equilibrium exists among these multi-molecular species and single water molecules at a given temperature and pressure. In contrast, in continuum models it is proposed that all possible hydrogen bonds are formed but that there is a range of bond strengths.

Regardless of the explanatory model employed, the absorption occurring at this frequency is very intense and it can only be studied in thin films of liquid or by

reflection methods. Thin film transmission techniques are technically more difficult than those used in reflection which has an additional advantage. Reflection methods, particularly the multiple internal reflection (MIR) method used in this study, measure absorption in the thin layer of molecules near the surface of the liquid. In terms of the mixture model, it is here near the surface that the smaller molecular species of water molecules, monomers, dimers and trimers are concentrated. These smaller molecular species contain a higher percentage of unbonded O-H groups than is found in higher analogues.

The earlier research suggests that the alteration produced in water samples acted upon by Therapeutic Practitioners affects the hydrogen bonding, either by changing the strengths of the bond, as in the continuum model, or by affecting change in the proportion of hydrogen bonded molecules, as the mixture model would have it. Whichever model is used to explain these changes, IR internal reflection spectroscopy is particularly sensitive to O-H variations, and is the appropriate technique for this measurement. We should also note that there is a possibility that what we are seeing is an entirely different interaction that happens to present itself in the infrared at the same frequency as the O-H bonding. It is, however, likely that the observed effect is a result of O-H bond changes rather than some unknown influence which happens to generate a similar absorption band.

In this experiment, the beam of infrared radiation used to measure the absorption reflects off the interface between a substance of very high refractive index and the liquid water, which has a lower refractive index. When this occurs, the electromagnetic wave penetrates a very short distance into the material of lower refractive index. To minimize this distance, in which the absorption is being measured, it is desirable to use the largest angle of incidence relative to the perpendicular and to have as high as practical a refractive index in the internal reflection element. Since the penetration depth can be made very small by these techniques, on the order of a single wavelength of the infrared radiation, the absorption incurred during each reflection is slight. Therefore it becomes essential that the infrared beam undergo many reflections and absorptions in order to accumulate an easily measurable total absorption. The MIR unit used in this study routes the infrared beam through 25 reflections.

With these considerations in mind, and in view of the earlier research on Therapeutic Touch effects on the IR spectrum of water, we attempted to design an experiment that would show the largest obtainable effect and measure it accurately and reliably. The Practitioners were motivated by placing them in a real healing session. The design of the experiment incorporated multiple levels of controls and produced a data set of sufficient size and consistency for statistical evaluation.

HYPOTHESES

HYPOTHESIS ONE: The Null Hypothesis predicts that there will be no significant difference in the ratio, defined below, resulting from infrared spectrophotometric analysis of the water from each session, whether the sample comes from a Calibration Control, Session Control, or a Treated water vial.

We predict that in some or all of the Treated samples, a change in the infrared spectra of the samples will occur such that the ratio, defined below, will have a reduced value in comparison with the Session and Calibration Control samples. We expect that some Practitioners will be more effective in producing the decreased ratio value than others.

HYPOTHESIS TWO: The second Null Hypothesis predicts that there will be no differential between 5-minute exposed vials and those exposed for 10 or 15-minutes.

We predict that the magnitude of the change in the ratio value will increase with exposure time to the Practitioner, the change being greatest in the 15-minute samples.

PROTOCOL

DESIGN

This pilot study is designed to explore an effect evidenced in the O-H bonding of water as a result of the intent and action of one person to therapeutically influence another. The independent variable is the action and intent of the Practitioner; the dependent variable is a ratio derived from the infrared spectrum.

Although the water samples are the focus of this research, in order to create an optimal setting for studying the independent variable, trials were carried out during actual therapy sessions. In earlier research the Practitioners directed their therapeutic intention directly into the bottles. However, with "intent" as our independent variable, an actual therapeutic session with its possibility of effective aid to a fellow human being, presumably, held greater motivation than acting solely on bottled water.

DEFINITION OF DEPENDENT VARIABLE: We measured the absorption at two frequencies ($f_1 = 3620 \text{ cm}^{-1}$, $f_2 = 3350 \text{ cm}^{-1}$) at the peak and shoulder of the absorption band. To normalize the absorbance values, a baseline was constructed beginning at 3800 cm^{-1} across to 2700 cm^{-1} . (See *Illustration One and Figure Two*)

Infrared Spectra Alteration in Water

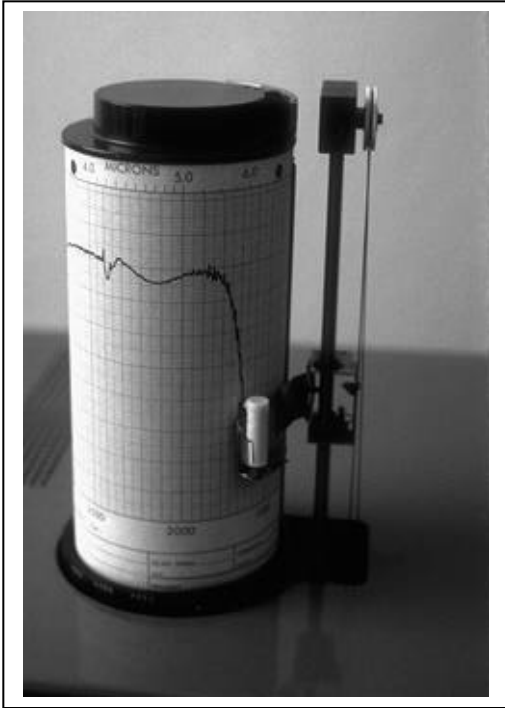


Illustration One

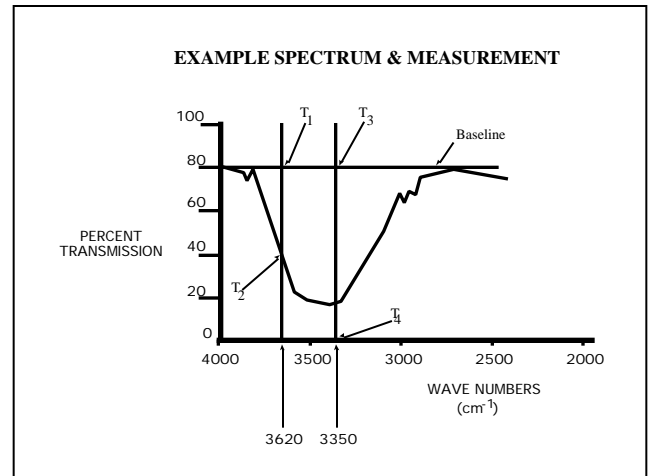


Figure Two

Illustration One shows an actual spectrum. Figure Two is an example spectrum and the points of measurement from which the ratio was developed.

THE DEVELOPMENT OF THE RATIO

The absorbance at 3620 cm^{-1} , A_u , is defined by:

$$A_u = \log \left(\frac{T_1}{T_2} \right) \quad (1)$$

Similarly, at 3350 cm^{-1} , A_b , is defined by:

$$A_b = \log \left(\frac{T_3}{T_4} \right) \quad (2)$$

Then, the dependent variable R is given by:

$$R = \frac{A_b}{A_u} = \frac{\log\left(\frac{T_3}{T_4}\right)}{\log\left(\frac{T_1}{T_2}\right)} \quad (3)$$

Although this definition of R already gives a first order correction for absorption variation due to environmental and instrumental factors, for this pilot study, we measured ambient temperature and barometric pressure, as well as logging the duration and starting and ending times for each phase of the Therapy Session and the spectrophotometric analyses. The history of motion during the experiment phase of the study was recorded by video-taping each session.

VIAL NUMBERING & UTILIZATION: Sixty-one vials were uniformly marked with an integer from 1 to 61. From the total pool of 61 vials, utilization occurred as follows: forty-two vials were treated on the basis of three for each healing session (3 x 14 = 42); nineteen were designated as controls -- fourteen to be matched, one each, with each session's set of treated vials; and five to be used as Calibration Controls, one per day, before each analysis of session samples.

CONTROLS: There were two levels of control samples in this study:

1. Calibration Controls: Prior to each day's initial session, one vial was randomly selected and designated the Calibration Control. It was used as a relative reference point, reflecting environmental variables, against which to evaluate the Treated and Session Control samples. A Calibration Control spectrum was run by each spectroscopist prior to taking the spectrum of each of the remaining four vials in each 5 vial session set.

2. Session Controls: Each Therapy Session had four vials randomly assigned to it. One of these was designated as the Session Control. This vial served as a second level of control. Its history was the same as those designated "Treated", except that it was not taken into the Therapy Session Room and was not handled by the Practitioners.

PROPOSED ANALYSES: Testing the stated hypotheses involves a comparison of the mean values of R found for the three sample populations of Treated, Session Controls and Calibration Controls. It was determined that, depending on the distribution of the R values in these populations, a suitable statistical test (t-test for

normal distributions, Mann-Whitney U test for non-normal distributions) would be chosen to determine whether there was a significant difference between these mean R values. The nature of the distribution would be determined by the Rankit graphical method.¹¹ Possible artifacts of temperature, barometric pressure, and variations dependent on sampling order would be examined and such effects corrected for if possible.

Because the measured R values might vary in time after the sessions, the analyses of the water samples were held at the same times each day with uniform intervals between each analysis session and within each session's five spectra run.

We will explore one evaluation of Practitioner sub-populations -- a comparison by group, not individual, between "Practising" and "Non-practising" Therapy Practitioners.

PARTICIPANTS: There were four categories of personnel involved with this study:

1. Practitioners: Fourteen Practitioners participated. Practitioners (Practising and Non-practising) are defined here as individuals who attempted, by other than medical means, to beneficially effect the health of ailing individuals. (See page nine, Therapy Sessions.) Six of the Practitioners were individuals who had participated in other Mobius research, seven were from the staff of The Healing Light Center Church (HLCC), and one was an independent Practitioner. Therapy Practitioners are considered as Practising if they have received training and characteristically administer Therapy Sessions of this type. They are classified as Non-practising if they have received no training, and/or do not characteristically function as Practitioners.

2. Recipients: Recipients were people with diagnosed illnesses. It was presumed by their association with this experiment that they were open to the feasibility of treatment in this way. Most (11 of 14) of the Recipients were drawn from the client list of the HLCC; the others were known to Mobius personnel. Selection criteria were limited to time, availability, and the desire to find people with genuine need who might best motivate the Practitioners. The ailments were pronounced and included lung cancer, AIDS, Arthritis, and recovery from surgery. Recipients were apprised of the nature of the experiment and the reasons for the presence of cameras, vials, and personnel during a pre-session orientation meeting with a Mobius researcher. No fees were collected for the therapeutic services rendered during the course of this experiment series.

3. Researchers: Three researchers were involved in the execution of this pilot study. Researcher 1 controlled all assistants and materials, coordinated all therapy sessions, and ran all randomization programs. Researchers 2 and 3 carried out the spectrophotometric measurements of the water samples.

Researcher 1 was blind to any information pertaining to the IR measurements taken by Researchers 2 and 3. Researchers 2 and 3 were blind as to who the Practitioner and Recipient were, when and for how long each Practitioner had treated the water samples, and which vials had been designated Session Controls. Each was also blind to the spectra obtained by the other spectroscopist.

4. Video Coordinator: A video cameraman, independent of the three researchers, had the responsibility for the taping. He was blind as to the number or time assignment for each vial, as well as the outcome of the spectrophotometry analyses. A video-record, including timing, was made of each session. A log marking the time the sessions began and ended, time code numbers, Practitioner and Recipient code references, and the tape cassette was maintained by the Video Coordinator.

THERAPY SESSIONS: Sessions lasted approximately 45 minutes, during which time Researcher 1, the Practitioner and the Recipient were present in a small room equipped with a typical padded therapy or massage table and a chair. The video coordinator was outside of the Session Room viewing the activities on the monitor. Typically during the Therapy Session, much as Krieger describes, passes of the hands were made, over the subject's body, and verbal communication was employed.¹² Each Practitioner was allowed to use their own procedure during the healing sessions. While none of the Practitioners were specifically trained in Dr. Kreiger's method known as Therapeutic Touch, many operated outside the context of Laying-on-of-Hands. The difference, as interpreted by Kreiger, and reported by Dean, is described as follows:¹³

THERAPEUTIC TOUCH

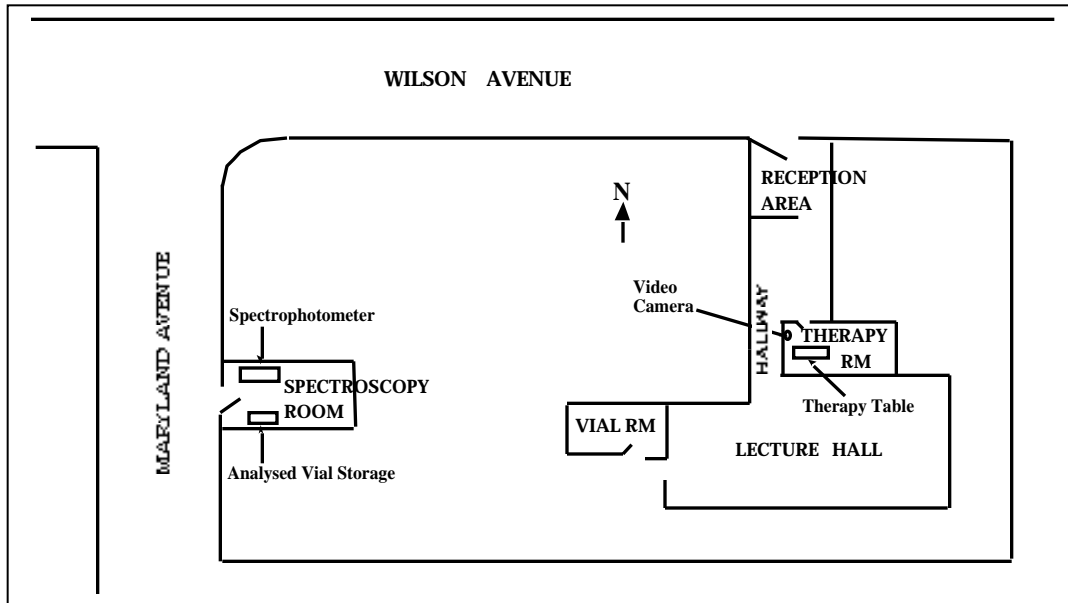
- Medical or nursing context.
- No correlation between the professing of faith and healing faith
- A natural potential which is actualized or made to happen.

LAYING-ON-OF-HANDS

- Usually in a religious context.
- Usually considered related to healing, or spiritual healing.
- Thought of as a gift, or as of the spirit.

Table One

Infrared Spectra Alteration in Water



Schematic lay-out of the Healing Light Center in Glendale, California where the experiment took place.

Figure Three

There is no definitive term which adequately covers the approaches of this study's Practitioners, but just as some clearly fell under the Laying-on-of-Hands definition, others were much more clearly aligned with the Therapeutic Touch categorization (including a registered nurse and medical doctor who participated as Practitioners). No medication, manipulation, or physical intrusion into the Recipient's body was involved.

HUMAN EXPERIMENTATION: In accordance with Federal Standards for human experimentation, all participants in this experiment series signed a release. This release is based on one approved by the UCLA Human Subject Protection Committee 9 August 1985.

APPARATUS:

1. Experimental Area: This experiment occurred in three rooms in the HLCC. The room where the spectroscopy took place was isolated from the room where the Therapy Sessions took place, and could be reached only through its own exterior door. (See Figure Three)



The water vials. On the left as used in the sessions, on the right cap seal off showing rubber seal through which needles were inserted.

Illustration Two

Infrared Spectra Alteration in Water

2. Water Samples: Three flats (25 per) of 50ml single dose (containing no alcohol preservative) vials of bacterial-static water for injection were purchased from a medical supply house. They all came from the same lot. The vials each had a break-off, tamper-proof cap. Vials obtained were INVENEX; Single Dose Vial; 50ml; No. 185-50; STERILE WATER FOR INJECTION, USP; pH 5.0-7.0; Lot #1858547N-F; Expiration date 30NOV89. (See *Illustration Two*)

3. Water Vial Holder: The water vial holder was a tube sewn closed at one end made of Creslan™ -- a white nylon-like material. The vial was slipped into the tube and positioned against the Practitioner's palm. Velcro™ patches at each end of the tube were fastened in place on the back of the hand to hold the vial securely against the palm. The Practitioners then went about their normal practice with minimal consideration for the intrusion of the water container.



The water vial holder containing a vial in place during a session.

Illustration Three

4. Pseudo Random Number Generator (RNG): To make all vial assignments, a pseudo-random number generator seeded from the computer's internal clock was used. The seed number was the elapsed seconds from the preceding midnight.

5. Barometer and Thermometer: A Micronta 63-841 thermometer calibrated to tenths of a degree centigrade and a Giscard aneroid barometer calibrated to tenths of an inch were located next to the spectrophotometer in the Spectroscopy Room.

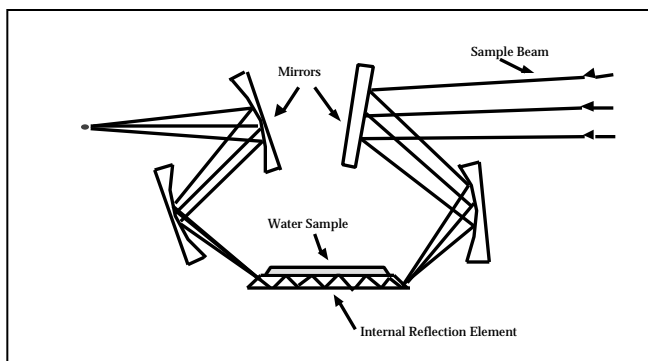
6. Vial Rack: A Styrofoam disk, measuring approximately 6" in diameter by 3/4" thick, had four holes cut in its top to seat four vials. The rack was used to transport the vials to and from the Therapy Session Room, Vial Storage Room, and Spectroscopy Room. Its circular form was designed to obviate unconscious cueing by any arrangement of the vials in a line. (See *Illustration Four*)



Vial Rack with vials, after a session. Note number labels.

Illustration Four

7. Spectrophotometer: The Spectrophotometer used was a Perkin-Elmer grating infrared model 237B with a drum recorder. All trials were run at fast setting, Grating Slit 7.



Multiple Internal Reflection Unit Schematic

Figure Four

8. Multiple Internal Reflection Unit (MIR): A JANOS Technology Corporation MIR was used in conjunction with the Perkin-Elmer spectrophotometer. The MIR unit consists of four mirrors that route the light beam through the sample. (See Figure Four)

held together by four knurl top screws. Each plate has an oval section routed out; into this is fitted an "O" ring gasket. Each plate is topped by a fitting suitable for attachment to the syringe holding the sample. These fittings channel into tubes cut in the steel, and it is in this way that the liquid sample is introduced, until the void caused by the routing is filled -- to be held in place by the "O" ring as it lies uniformly along the surface of the internal reflection element. (See Illustration Five)

9. The Sample Cell: This is essentially two plates of steel

10. Internal Reflection Element (IRE): The IRE resembles a standard microscope slide, except that it consists of an infrared transparent material, with ends cut at a 60° bevel.

The 60° bevel was used in our IREs (and dictated the placement of the cell in the MIR) because, as Harrick reports, of three optional angles available for the MIR, 60° produces the shallowest penetration of the water and, hence, the most sensitive measurement of the O-H bonding relationship in the sample.¹⁴



Sample cell, being dried between measurements. Note also needle and syringe ready for discard. Each was used but once.

Illustration Five

PROCEDURE

SCHEDULING: Two schedules need to be borne in mind:

1. Overall Schedule: The experiment series was run over the course of five days. No more than three healing sessions were run in any one day. Three days produced 30 spectra. Because of the substitution of the zinc selenide for the broken germanium plate, one day produced 31. One day had only two sessions producing 20. The total number of spectra was 141. The spectroscopy kept to the planned schedule allowing 60 minutes between each session's two spectrophotometric analysis periods. It took approximately 60 minutes to run five analyses ($12 \times 5 = 60$). It took approximately 40 minutes from the time the 15-minute vial of a given session left the Practitioner's hand, until the first spectrum was made.

2. Individual Session Schedule: With the first vial in place in the cloth vial holder, each Practitioner began the session with the Recipient. Researcher 1 kept track of the time, down to seconds, that each vial was exposed. Using a stopwatch, he began timing as soon as the vial was proximate to the Practitioner's hand and stopped timing when the vial holder was removed. The first vial was in place for five minutes, the second for ten minutes, and the third for fifteen minutes. To avoid creating any sense of pressure on either Practitioner or Recipient, the Practitioner was then allowed any additional desired time, without a vial in place, to reach a satisfactory closure on the session.

SPECTROPHOTOMETRIC MEASUREMENTS: There were two measurements taken of each vial assigned to a given session:

1. First Measurement: Researcher 2 carried out the first measurement. Every sample of water was extracted from the vial using a fresh, sterile, disposable 5ml syringe and needle. The sample was taken directly from its vial and deposited onto the Janos MIR unit's Sample Cell. After each measurement the MIR Sample Cell was taken apart, and it and the IRE were dried completely. Each analysis session began with a calibration run. The barometric pressure, scan split, grating slit, temperature and starting and ending times of the run were logged on the spectrum chart as well as another form.

2. Second Measurement: Researcher 3 repeated the water analysis on the same spectrophotometer at a pre-determined interval after the first measurement was completed. In this way each vial was analyzed twice by different people, obviating criticisms of an individual's measurement technique or the postulation of some influence across the samples by the analyzer rather than the Practitioners.

The following steps describe the sequence of events which occurred in each day's sessions.

Infrared Spectra Alteration in Water

SPECTROPHOTOMETRY TRACK
Researchers 2 and 3

First Session

- 1.) Allow instrument to reach equilibrium Calibration; this vial to
- 2.) Check gain and operating features
- 3.) Run zero-line spectrum using sample from Calibration Control
- 4.) Run 100 per cent line
- 5.) Run "dry" IRE background spectrum

THERAPY SESSION TRACK
Researcher 1

First Session

- 1.) RNG to select Daily Control Spectroscopy Room
- 2.) Video Coordinator sets up
- 3.) Briefing of Practitioner and Recipient
- 4.) Obtain permissions
- 5.) Participants fill out Mobius Meyers-Briggs(J). Personality Inventory.. Recipients give medical history
- 6.) Vial assignment for session via RNG.
- 7.) Three designated Treated vials removed from Storage Room and taken to Therapy Room.

Designated Session Control remains in Storage room.
- 8.) Begin Session.
- 9.) Timed vials and logged timings.
- 10.) Video-taping carried out.
- 11.) Video log maintained.
- 12.) End Session.
- 13.) Treated vials placed in carrier rack and session control added.
- 14.) Vials taken to Spectrophotometry Room.

Infrared Spectra Alteration in Water

6.) Receive vials. debriefed.

15.) Participants independently

7.) Run Calibration Control spectrum.

8.) Cleanse IRE.

9.) Run session vials logging temperature pressure, starting and ending time for each spectrum as well as run speed and grating slit used.

16.) Prepare Therapy Room and barometric obtain workbooks for next session.

BREAK

BREAK

10.) Second Calibration spectrum run.

11.) Second running of session vials logging temperature barometric pressure, starting and ending time for each spectrum as well as run speed and grating slit; vials stored.

SECOND SESSION

SECOND SESSION

Steps 6-11 repeated as in Session One

Steps 3-16 repeated as in Session One

**SPECTROPHOTOMETRY TRACK
Researchers 2 and 3**

**THERAPY SESSION TRACK
Researcher 1**

THIRD SESSION

THIRD SESSION

Steps 6-11 repeated as in Session One

Steps 3-15 repeated as in Session One

12.) At day's end, transformation of spectra measurements into ratio values

13.) Computer entry of raw data

Table Two

RESULTS

HYPOTHESIS ONE: We predicted that in some or all of the Treated samples a change in the infrared spectra would occur such that the defined ratio would have a reduced value in comparison with the Session and Calibration Control samples. We

Infrared Spectra Alteration in Water

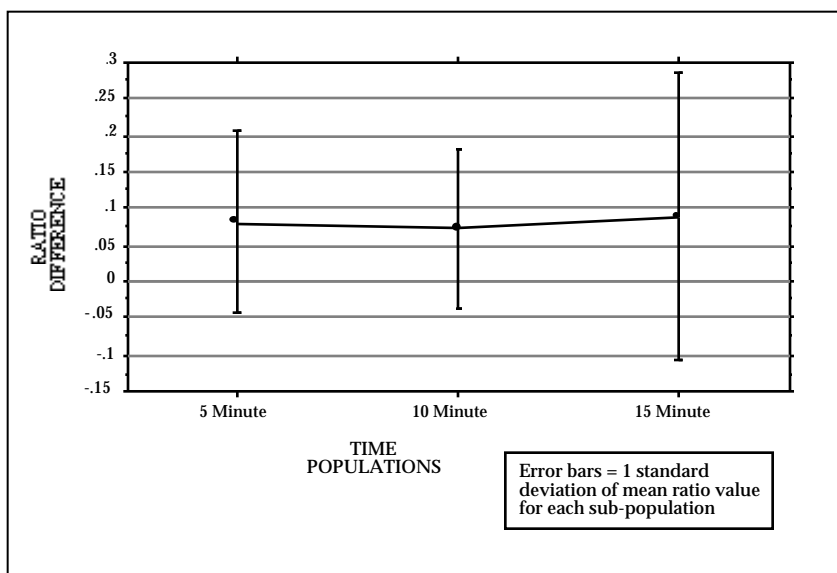
expected that some Practitioners would be more effective in producing the decreased ratio value than others. The results confirmed these predictions.

**MANN-WHITNEY U TESTS
(Temperature Adjusted Ratios)**

	Z SCORES	P VALUE [one tailed]
GERMANIUM & ZINC SELENIDE IREs:		
ALL TREATED vs ALL CONTROLS	-2.03	0.02
ALL TREATED vs CALIBRATION CONTROLS	-2.93	0.002
ALL TREATED vs SESSION CONTROL	-0.26	0.4

Table Three

HYPOTHESIS TWO: We predicted that the magnitude of the change in the ratio value would increase with exposure time to the Practitioner, the change being greatest in the 15-minute samples. This was not confirmed ($p > 0.2$). (See Figure Five)



Changes in Ratios by Time of Exposure

Figure Five

INTER-SPECTROSCOPIST CALIBRATION CONSISTENCY: The uniformity of the mean values and standard deviations between the two spectroscopists suggests no significant difference between their performances. Calibration Controls show

Infrared Spectra Alteration in Water

relative consistency, both by spectroscopist and between spectroscopists, indicating correct measurement technique and consistent sampling. (See Table Three)

**MEAN VALUES & STANDARD DEVIATIONS
BETWEEN THE TWO MEASUREMENTS**

	SPECTROSCOPIST ONE		SPECTROSCOPIST TWO	
	MEAN	STND. DEV.	MEAN	STND. DEV.
Calibration				
Controls	3.27	0.14	3.27	0.15

Table Four

DATA DISTRIBUTION: Using the Rankits (graphic analysis) approach, a linear transformation of the ratio values for each population was performed using tables giving rankit values in relation to population N.¹⁵ These values were plotted on semi-logarithmic (1 cycle 70 divisions) paper. From this a skewed distribution was apparent, which determined that the Mann-Whitney U Test was appropriate.

INTERNAL REFLECTION ELEMENT VARIATIONS: At the beginning of the fourth measurement of the second session the germanium plate from the MIR unit broke; in its place we substituted one of zinc selenide. The germanium IRE, with its higher refractive index, consistently produced lower ratios and, thus, artificially skewed the combined overall analysis. We eliminated the 15 (of 141) ratios from all vial categories taken with the germanium IRE. The germanium ratios alone constitute too small an *n* to achieve truly meaningful results. The zinc selenide ratios alone yield:

ZINC SELENIDE IRE ONLY
(Temperature Adjusted Ratios)

	z SCORES	p VALUE [one tailed]
ALL TREATED vs ALL CONTROLS	-2.56	0.005
ALL TREATED vs CALIBRATION CONTROLS	-3.54	0.0004
5 MINUTE	-3.06	0.001
10 MINUTE	-2.52	0.006
15 MINUTE	-3.02	0.001
ALL TREATED vs SESSION CONTROL	-0.46	0.3
CAL. CONTROLS vs SESS. CONTROLS	-2.8	0.002

Table Five

Infrared Spectra Alteration in Water

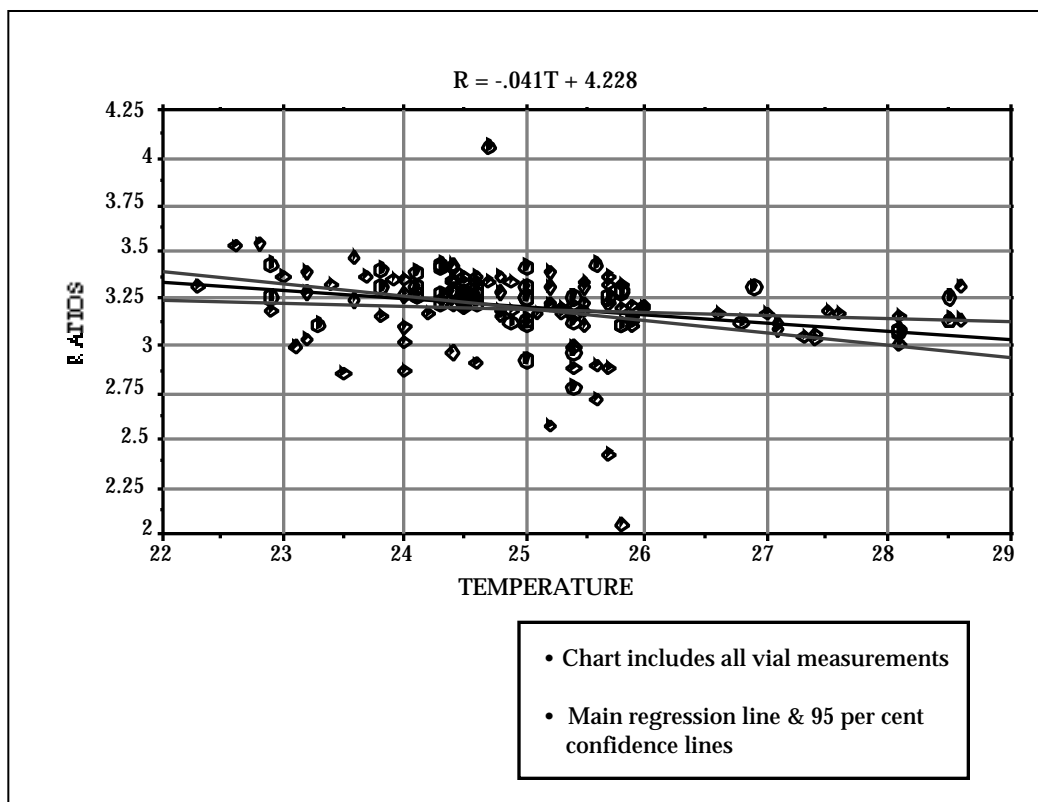
ENVIRONMENTAL EFFECTS

The following ranges of temperature and barometric pressure were recorded during the course of the experiment:

TEMPERATURE:	BAROMETRIC PRESSURE:
Range = 6.3 °C	Range = 0.3"
Maximum 28.6 °C	Maximum 30.1"
Minimum 22.3 °C	Minimum 29.8"

Table Six

TEMPERATURE: We plot below the observed ratio values against the recorded room temperature at time of analysis.



Temperature vs. Ratios

Figure Six

The ratios show a slight negative temperature coefficient across the aggregate samples. This same slight negative slope was observed in both germanium (-0.08)

and zinc selenide populations (-0.055), and within all vial populations. It should be noted that ambient temperatures only were recorded and used in the above plot.

This effect of temperature on infrared absorption bands is well reported in the literature, and there have been several studies of water focusing specifically on the absorption bands studied in this experiment. Unfortunately, none of the studies use the Attenuated Total Reflection (ATR) spectroscopy technique employed here. However, two studies of reflectance IR spectra^{16,17} and a further study of the Raman spectrum in this region¹⁸ report values for the temperature coefficient of R consistent with one another and comparable to that observed in this study. Thus, although the unreported ATR method may give slightly different band profiles from reflectance IR and Raman spectroscopy, the uniformity of the two other approaches suggests that samples measured in this experiment by ATR should show, as they do, a similar temperature coefficient. Because the observed temperature coefficient is of the same sign and order of magnitude as the published values, it is probable that this study is seeing an effect on R due to the sample temperature, and not an artifact produced by equipment fluctuation.

The temperature shift required to produce a mean effect equal to that observed in this study -- $R = -0.08$ -- is shown below for water samples with a reference temperature of 25°C. The mean temperature of this study was 25.8°C.

EXAMPLES OF TEMPERATURE EFFECTS ON R

Temperature Coefficient °C ⁻¹	°C+ to Mimic Mean Observed Effect	Spectroscopy Technique	Source
-0.041	2.0	ATR-IR	This study
-0.027	3.0	Reflectance IR	Pinkley <i>et al</i>
-0.021	3.8	Reflectance IR	Hale <i>et al</i>
-0.026	3.1	Raman	Schultz and Hornig

Table Seven

To mimic the mean effect observed in this study, a 2-degree difference of room temperature would be required between sampling the Treated and Calibration Controls. This magnitude of temperature shift was not observed; the mean shift was 0.44 °C. To encompass the full range of the effect would require a change of +11°C as some samples changed by $R = -0.46$.

However, since we only recorded the ambient temperature during the spectrophotometric sessions other considerations need to be examined. One concerns whether it is possible that the handling of samples during treatment sessions resulted in their having higher temperatures at measurement than Calibration or Session

Control samples, something that would not be reflected in the ambient measurements. To explore this question a worst-case scenario was constructed, and a series of post hoc experiments was carried out.

Under most circumstances, the Creslan vial holder positioned only a part of the cloth covered vial surface against the Practitioner's slightly cupped palm. (*See Illustration Three, page 11*) To create the worst case we tightly grasped unsheathed sample vials, from the same lot used in the main study, for 15 minutes in the naked hand. Fifteen minutes of such exposure raised the water temperature in the vial, by 10°C above the mean ambient temperature of 25.8°C. Measurements were taken using a Tegam digital thermometer, model 875F (verified calibration to 0.1°F), equipped with a 24-gauge Type T thermocouple sensor, with a time constant < 1 second. The sensor was inserted through the rubber seal directly into the approximate center of the vial. The water within the vials was then allowed to equilibrate towards ambient.

The thermal time constant of the water within the vials was such that the temperature differential between sample and ambient halved every 29 minutes. Spectra from a given session were taken from 15-73 minutes after the time a vial left the hand of the Practitioner. Second spectroscopic measurements typically occurred an hour and a half after that. Using the worst case determined by the first post hoc experiment -- a sample heated to 10°C above ambient temperature and then measured only 15 minutes later -- and given the established thermal time constant, we found that a vial would be 7°C above ambient at the time its first spectrum was taken.

This led to exploration of a third temperature issue involving the Sample Cell/IRE unit itself (*See Illustration Five, page 12*). Could handling of the unit introduce a temperature effect not revealed by the ambient measurement? *Post hoc* experiments were carried out in which the thermocouple sensor was inserted, via the same channel through which the water was injected into the "dry" Sample Cell, as it was being handled during the preparation for spectra taking. An ambient reading was taken and 1.5ml of water was extracted from the previously held vial and injected into the Sample Cell. The sensor was re-inserted into the water-filled Sample Cell, which was placed into the MIR and readings were taken at the beginning and end of the two minutes required to take a spectrum. During the course of a typical five vial measurement session, we found that the Sample Cell temperature varied above ambient by no more than 0.5°C between spectrographic measurements, and that even this rise dissipated during the approximately 3 minute period it took to prepare for the next spectrum taking. These experiments also revealed that samples 7°C above ambient, which were injected into the IRE for spectrophotometric analysis equilibrated very rapidly and closely to the temperature of the Sample Cell. This is not surprising since the 1.5 ml of water in the Sample Cell cavity is spread out in a shallow film within a steel casing.

These post hoc studies make it clear that, since the metal has a much greater thermal capacity than the water, the Sample Cell temperature is the significant factor in deter-

Infrared Spectra Alteration in Water

mining the sample temperature at the time of spectroscopic measurement, and that temperature increase within the vials, caused by handling, is not a significant factor. Similarly, handling the metal Sample Cell is not a significant concern because of the waiting time it took to prepare the spectrophotometer for the next spectrum measurement.

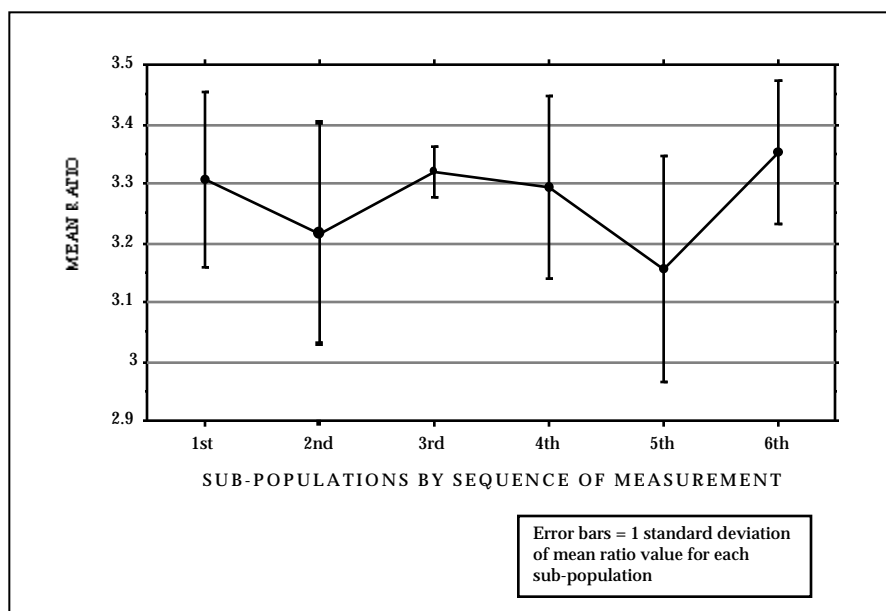
Having thus established that spectra were taken at a temperature approximating ambient, we corrected for the slope observed in the regression line, producing an adjusted ratio, R_a by:

$$R_a = R + 0.041(T-25) \quad (4)$$

Where R_a = the temperature adjusted ratio, R = the uncorrected ratio, and T = temperature.

The Mann-Whitney U Tests were then run using the corrected ratios from both the germanium and zinc selenide populations. The results of these calculations provided data, upon which the Hypothesis One analysis was based, although the z score difference between the two datasets was quite small. The z score difference between the adjusted and unadjusted ratios, in the most pronounced category, Treated vs Calibration, changed only from -2.97 to -2.93.

BAROMETRIC PRESSURE: The barometric pressure was logged at the time each spectrum was produced and over the course of trials covered a range of only 0.3". These were optimal experimental conditions, but because this range was so small, we can say nothing concerning the pressure-ratio relationship.



Sub-populations by Sequence of Measurement

Figure Seven

SAMPLING AND ORDER VARIATIONS: There is a second possible pressure effect to consider. Air was pushed into the vials through the syringe and needle in order to offset the vacuum created by withdrawing the water sample. The Treated and Session Control vials each underwent two measurements, while each of the Calibration Control vials underwent either four or six, depending on whether two or three sessions were held on a given day. Presumably, since the Calibration Controls experienced the greatest variance for this factor, they should show the greatest range of effect. To explore this we took the mean of the ratios of each measurement category, i.e., all first-of-the-day Calibration Control sample ratios, all second-measurement-of-the-day Calibration Control sample ratios and so on up to measurement six. When charted this reveals:

PRACTITIONER SUB-POPULATIONS

The total population of Practitioners was considered as being made up of two sub-populations, Practising and Non-practising. Using the zinc selenide IRE, we compared the Treated vs. Calibration Control sub-populations. This resulted in the elimination of two actively Practising Therapy Practitioners, leaving seven Practising compared with five Non-practising. The comparison showed:

MANN-WHITNEY U TEST (Temperature Adjusted Ratios)

		[one tailed]
ZINC SELENIDE IRE:		
PRACTISING (Treated vs Calibration Controls)	-3.08	0.001
NON-PRACTISING (Treated vs Calibration Controls)	-1.75	0.04

Those who trained in some kind of therapeutic technique, and characteristically involved themselves in such activities, produced more significant results than those who had not undergone such training or who did not characteristically involve themselves in such activities.

DISCUSSION

The central difficulty in interpreting this experiment's results lies in the Session Controls, a few of which also show evidence of having been acted upon. For reasons discussed in the results section, we do not feel that environmental effects provide a compelling explanation for either the overall effect, or for the changes in the Session

Control sub-population specifically. However, eliminating temperature as a cause does little to advance our understanding of what affected the water samples. If the effect is not the result of environmental factors, what could have caused the change in the IR spectra? In seeking an answer to this question, the fact that only some Session Controls were affected lends possible support to two explanatory models:

EMOTIVE-INTENTION MODEL: The independent variable of this experiment was the "intent" of the Practitioner, and this therapeutic intent may have, as a major component, a highly charged emotional state. This model, in addition to proposing a partial explanation for the overall effect, suggests that we neglected to fully appreciate the psychological impact produced by a Therapy Session in designing the experiment. Researcher 1 also had a highly emotional experience, and he alone knew the identity of all four samples from each session, including which was the control. He was the only person who handled the Session Controls until they were delivered to the Spectroscopy Room. Since the Calibration Controls show no effect, the Session Controls presumably were not affected by any factor in the spectroscopy room.

At the time of the sessions Researcher 1 sometimes reported being deeply "moved" and "excited". So powerful were these experiences that Researcher 1 was later shown to have ineptly handled a tape recorder with which he was fully familiar, and which he had used many times over several years. He could qualify as being in an altered state as Ludwig defines the word.¹⁹ If one considers the correlation between high emotion and extraordinary human performance of all kinds, the possibility of Researcher 1 being an affecting agent cannot be eliminated. Indeed, an extreme scenario could be developed in which all affected vials were the result of some influence on the part of Researcher 1, and that the Practitioners produced none of the effect.

PROXIMITY MODEL: The Treated and Session Control vials from each Therapy Session were within several inches of one another and may have had some direct glass-to-glass contact. This model proposes that some undefined field effect, perhaps along the lines discussed by Sheldrake and others²⁰ caused the Treated Vials to affect the Session Controls through proximity. The Proximity Model might co-exist with the Emotive-Intention Model, but alone it does not explain how the Treated samples were affected, unless one postulates that the few affected Session Controls caused changes in the Treated samples during the time the last vial left the hand until the first measurement was taken in the Spectroscopy Room. How this might occur through the glass of the vials we do not speculate. This experiment did not control for such an effect.

FUTURE RESEARCH: Subsequent work should do more than replicate the existence of the effect observed in this study; it should give a more accurate reading of true magnitude. Similarly, it should also refine how long it takes to affect the water.

What we can say with this dataset is that the size of the phenomenon does not increase simply with time of exposure, and that it can take five minutes or less to produce a significant change. Both the Emotive-Intention and Proximity models could conceivably produce such a change.

We must: 1) Reduce system noise by utilizing even higher purity water and employing a more advanced spectrophotometer which allows for continuous calibration readings; 2.) Monitor sample temperature at the IRE and create baselines establishing the exact nature of any temperature coefficient through repeated trials on water samples at different controlled temperatures; 3.) Implement greater automation, involving continuous Teflon tubing, rather than water vials, in this way eliminating researcher handling of the samples, and allowing for greater sampling frequency per session. This could potentially answer questions as to how long it takes to cause change in the samples, and possibly lead to evaluation of individual practitioner effects; 4.) Maintain strict separation of Control and Treated water samples and carry out proximity studies to shed light on the existence of any such effect.

The selection of the palms of the hands as the site to monitor was based on the almost universal ethno-historical association of the hands with healing. This does not imply, however, that the palms are the only place on the body at which to place the water. Two small studies suggest that at least one other site exists on the body where water has been affected, and that proximity is an aspect whose parameters are not understood. Dean reports a successful experiment with a British woman, Rose Gladden, where the bottle was placed at her throat.²¹ Brame describes an experiment in which a group of people were several feet from a target vial.²² The anecdotal literature of absent healing, where Practitioner and Recipient are separated, sometimes by long distances, suggests that distance may be no more a factor in this effect than it is in Remote Viewing.²³

The comparison between those individuals trained, and experienced, in such therapeutic activities, and those who are not, has been explored in only a preliminary way. While the results clearly suggest a correlation between experience of Practitioner and robustness of effect, this dataset does not directly speak to finer analyses concerning individual Practitioner techniques. The results do suggest that even with no training, or regular practise, it is possible to alter the IR spectrum if the intent is strong. For this reason, we feel this issue of intent is very significant and should be a major consideration in any experiment design.

This report does not take a position of preference for any specific technique. When more data has been collected, discussion will develop involving correlations with water analysis and the various ways in which Practitioners approached their task. At that time the tape recorded debriefings of each Practitioner and Recipient taken in this experiment immediately after their session will make their contribution.

Because this experiment focused on the water samples, the exact relationship between the water change and any improved physical or psychological well-being of the Recipients was not established. However, anyone viewing the video tapes of the session must recognize the profound nature of the experience for both Practitioner and Recipient, a conclusion reinforced in the debriefings held after every session. Relaxation and stress relief are unmeasured but obvious; a response consistent with a measured study reported by Quinn utilizing the STAI Self-Evaluation Questionnaire.²⁴ We have also subsequently received reports from Recipients as to their sense of effect. These include the anomalous disappearance of a kidney stone. The connection between the alteration of the O-H bonding state and a direct change in the well-being of the recipient is implied, but future research will be required before anything specific can be established.

A bridge between observed ratio shifts in Treated water samples and the improved health and well-being of the Recipients can be built by exploring a three-fold path: 1) A measurement in a non-living system outside of the body, a continuation of this research; 2) An objective physical measurement taken from within the body, possibly spectroscopy of blood samples; 3) A psychological stress and anxiety-reduction measurement in the form of a self-reporting instrument. If under the proper controls this linkage is established, say there is a shift in the O-H bonding in blood, and this correlates to a change in the body's immune response, perhaps we will begin to understand something of this therapeutic exchange so long reported in humanity's history.

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