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Unreliability of the Gas Discharge Visualization (GDV) Device and the Bio-Well for Biofield Science: Kirlian Photography Revisited and Investigated
Part II

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Abstract – This is the second part of a research work to study the reliability of the Gas Discharge Visualization (GDV) device and the Bio-Well: These biofield machines, which are based on the Kirlian effect, were put to test in a Pranic Healing experiment. In the first part, the literature on Pranic Healing and Kirlian photography, as well as the functioning of the devices, were reviewed. In this second part, previous reliability studies on Kirlian photography devices are reported, explaining their negative results, and an original experiment is presented. The measurement variability and working of these technologies were investigated, evaluating their capacity to assess the energetic status of human beings and water. The experiment involved 40 participants: 20 Pranic healers and 20 non-healers. Healers performed a treatment on water, while non-healers simulated it; both groups were measured repeatedly before and after their real or sham performance; their water was measured as well and compared with controls. In the analysis, it was evaluated whether these Kirlian photography devices could return accurate, repeatable, and consistent information about the participants' and water energy fields, allowing to detect potential subtle energy changes in the healer group compared to the non-healer one. The GDV-device and Bio-Well parameters showed large measurement variability and/or poor informative value, resulting inconsistent at detecting possible subtle energy variations in human beings and water. The findings of this research indicate that the GDV device and the Bio-Well may not be reliable tools for biofield science, and suggest that the literature related to these technologies should be revised and questioned.

Keywords: Kirlian photography – GDV device – Bio-Well – Pranic Healing – Prana – subtle energy – biofield – biofield devices – electrophysiology – bioelectromagnetism

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Unzuverlässigkeit des Gasentladungsvisualisierungsgeräts (GDV) und des Bio-Wells für die Biofeldwissenschaft: Kirlian-Fotografie neu betrachtet und erforscht. Teil II

Zusammenfassung – Dies ist der zweite Teil einer Forschungsarbeit zur Untersuchung der Zuverlässigkeit des Gasentladungsvisualisierungsgeräts (GDV) und des Bio-Well: Diese Biofeldgeräte, die auf dem Kirlian-Effekt beruhen, wurden in einem Pranic-Healing-Experiment getestet. Im ersten Teil wurden die Literatur über Pranic Healing und Kirlian-Fotografie sowie die Funktionsweise der Geräte untersucht. In diesem zweiten Teil wird über frühere Studien zur Zuverlässigkeit von Kirlian-Fotografie-Geräten berichtet und deren negative Ergebnisse erläutert sowie ein eigenes Experiment vorgestellt. Die Messvariabilität und die Funktionsweise dieser Technologien wurden untersucht, um ihre Fähigkeit bzw. Eignung zu bewerten, den energetischen Zustand von Menschen und Wasser zu beurteilen. Das Experiment umfasste 40 Teilnehmer: 20 Prana-Heiler und 20 Nicht-Heiler. Die Heiler führten eine Wasserbehandlung durch, während die Nicht-Heiler diese simulierten; beide Gruppen wurden vor und nach ihrer tatsächlichen oder vorgetäuschten Behandlung wiederholt gemessen; auch die von den Heilern behandelten Wasserproben wurde gemessen und mit den Kontrollproben verglichen. In der Analyse wurde untersucht, ob diese Kirlian-Fotografiergeräte genaue, wiederholbare und konsistente Informationen über die Energiefelder der Teilnehmer und des Wassers liefern können, die es ermöglichen, mögliche subtile Energieveränderungen in der Gruppe der Heiler im Vergleich zu der Gruppe der Nicht-Heiler zu erkennen. Die Parameter des GDV-Gerätes und des Bio-Wells zeigten eine große Messvariabilität und/oder eine geringe Aussagekraft, was dazu führte, dass mögliche subtile Energieveränderungen bei Menschen nicht erkannt werden konnten.

Schlüsselbegriffe: Kirlian-Fotografie – GDV-Gerät – Bio-Well – pranische Heilung – Prana – feinstoffliche Energie – Biofeld – Biofeldgeräte – Elektrophysiologie – Bioelektromagnetismus

Introduction

The Gas Discharge Visualization (GDV) device and the Bio-Well, developed by Konstantin Korotkov, are two biofield machines based on the Kirlian effect and electrophotonic imaging (Korotkov, 2002, 2011, 2014, 2017; Korotkov & Jakovleva, 2013; Korotkov & Yusubov, 2012). Specifically, the object to test is placed in a high intensity and high frequency electric field, an electron discharge is induced on its surface, the surrounding air molecules are ionized, and the photons emitted in the process are photographed. The discharge snapshots, which are called GDV-grams, are then analyzed by a computer software. Numerous parameters are calculated for human fingertips and liquid drops, in order to assess their energetic status and potential. The parameter calculation involves the number of pixels with value above the threshold, pixel value, length of the GDV-gram contours, etc. Parameters are often compared with the ideal case, i. e., the glow of a metal cylinder which is used to calibrate the devices. While they are based on the same principle of working, the Bio-Well is a newer and more compact model compared to the

GDV device: Its hardware is more sophisticated, its software more user-friendly, and its health report includes energy parameters.

GDV-Device Human Parameters:

- **Integral Area (IA):** For each body organ, part, or apparatus, it quantifies the amount of vital resources or functional reserves. IA coefficients are calculated as IA-1.
- **JS** and **RMS:** arithmetic average and root mean square of the IA coefficients. The closer JS and RMS are to zero, the more balanced and uniform organ areas are.
- **Activation Coefficient:** measures psychophysical stress and anxiety.
- **Integral Entropy:** reflects the functioning of the organism vital activities.
- **Form Coefficient:** is related to the level of physiological regulation.
- **Aura:** The fingertip emissions are mapped around the contour of a human figure to create an aura, whose **Area**, **Symmetry**, and **Entropy** are returned.
- **Energy Activity Level** and **Psychological Priority:** indicate respectively the amount of energy that flows through the dominant right-left chakra component, i. e., the strength of the chakra, and which is the dominant chakra component, i. e., whether the chakra is right- or left-shifted. Chakras are based on the Indian Ayurvedic model.

GDV-Device Liquid Parameters:

- **Area:** similar to the human Area.
- **Entropy by Isoline:** similar to the human Entropy.
- **Form Coefficient:** similar to the human Form Coefficient.
- **Spatial Fractality:** similar to the Form Coefficient.
- **Average Intensity:** of the GDV-gram.
- **Mean Radius of Isoline:** average radius of the GDV-gram.
- **Length of Isoline:** length of the GDV-gram external contour.

Bio-Well Human Parameters:

- **Area(C):** For each body organ, part, or apparatus, it is calculated by comparing the glow of a fingertip sector with that of the calibration cylinder. Area coefficients are calculated as Area (C) – 1. Raw values of the **Area**, not divided by the ideal case, are also returned.

- **Energy(C):** For each body organ, part, or apparatus, it is the energy of the light glow corrected to the angular size of the sectors. It shows the organ functional state.
- **Stress:** similar to the GDV-device Activation Coefficient. It shows the emotional pressure of the testee.
- **Energy:** measures the light glow energy of the overall field.
- **Balance:** symmetry of the energy field.
- **Organs imbalance:** imbalance in the organ energy.
- **Entropy Coefficient (EC):** similar to the GDV-device Integral Entropy.
- **Form Coefficient (FC):** similar to the GDV-device Form Coefficient.
- **Chakra Energy:** energetic activity of the Ayurvedic chakras.
- **Chakra Alignment** and **Asymmetry:** shift of the Ayurvedic chakras from the center.
- **Meridian Energy:** energetic activity of the Traditional Chinese Medicine (TCM) meridians.

Compared to the GDV device, energy parameters are introduced and measured in Joules.

With the GDV device, human measurements are repeated twice, without and with a thin polyethylene filter, placed on the surface of the optic glass. According to Korotkov, this plastic filter is able to screen out the subject's psycho-emotional response, because it cuts out the cutaneous covering, which is due to perspiration processes and thus reflective of the Autonomic Nervous System (ANS) activity. Therefore, filtered GDV-grams are used to evaluate the testee's physical condition, while unfiltered GDV-grams are used to assess their psychophysiological state. The use of a filter is not necessary with the Bio-Well.

A complete description of the GDV device and the Bio-Well, explaining in detail their functioning and parameters, is reported in the first part of this work. In this second part, the reliability of the devices was evaluated in a Pranic Healing experiment: The energy fields of human beings and water drops were analyzed to assess the effect of a treatment performed by healers on water, and results were compared with controls. While the literature abounds with publications claiming the usefulness of these devices in biofield science, previous studies on the reliability and utility of Kirlian photography returned negative results (Boyers & Tiller, 1973, 1976; Dakin, 1975; Gadsby, 1993; Jessel-Kenyon et al., 1998; Krippner, 1979; Marino et al., 1979; O'Regan, 1989; Shaduri, 2011; Treugut et al., 1998; Watkins & Bickel, 1986). Given the controversy, the aim of this research is to advance our understanding of the Kirlian technique and evaluate its use in biofield science.

Previous Reliability Studies on Kirlian Photography Devices

A previous study on the reliability of the GDV device was performed by Shaduri, who describes the inconsistency of Korotkov's technique as follows:

- Stimulated emission of human fingertips cannot be used for diagnostic purposes if one follows the operational protocol offered by the author of the device: results of patient examination depend upon the age of subjects, duration of object exposure, the perspiration of a body and ambient humidity, as well as many other poorly controllable factors such as subject's emotional state;
- Recordings of the same finger often differ from one another considerably, even when captured within 2–3 sec interval;
- Essential components of fingertips' emission are lost: the most intense shots leave dark gaps instead of bright streamers that are either scattered upwards or shifted out of the focal plane down to the periphery of polished surface of the screen (. . .). (Shaduri, 2011, pp. 30–31)

By improving the GDV technology and measurement procedure, Shaduri was able to obtain stable, repetitive, and informative imagery (Shaduri, 2011, 2016): She managed to produce photographs which consistently displayed the discharge pattern associated to the disease or biological condition of the testee. This may be evidence that fingertip electrophotonic emission does have the potential to provide accurate assessments about the organism physiology and health status; but commercially available devices and commonly used procedures are not well developed and designed. Shaduri reached this conclusion as well, noting that "the majority of commercially available devices provide non-reproducible, non-informative and extremely variable imagery" (Shaduri, 2011, p. 30). She also commented that the "Entire field of the bio-electro-photography was compromised, especially when certain GDV-technique users started to interpret the stimulated radiation of biological objects, e.g., the radiation of human fingertips, as a manifestation of mystic energy or 'live fields' of non-physical nature" (Shaduri, 2011, p. 30).

These findings seem consistent with those of another researcher, who studied Knapp's Plasma Print, a commercial Kirlian-photography device similar to Korotkov's, casting doubt upon its diagnostic validity (Jessel-Kenyon et al., 1998). After testing 30 patients, on 2 consecutive days at the same hour, he calculated the Correlation Coefficients (CCs) between the sets of measurements, obtaining low values (CC ~ 0.12 – 0.41). Jessel-Kenyon et al. thus concluded:

> The plasma print (Kirlian photography) shows very variable results in clinical practice and reliably shows the presence of toxicity. The location of organ disturbance is never consistent, as the plasma print is so variable. The results of this study again support this clincial [*sic*] impression. (Jessel-Kenyon et al., 1998, p. 42)

Moreover, also Mandel's Energy Emission Analysis (EEA) bioscan, based on the Kirlian effect, was tested and returned disappointing results (Treugut et al., 1998). At regular intervals of 10–15 min, 4 photographs of the finger and toe electrophotonic emission were captured for each of 30 patients, suffering from a variety of diseases. A low reliability was found, with an Intraclass Kappa of 0.14, which led Treugut et al. to conclude, quite optimistically:

> The reasons for the moderate reliability may be attributed to fluctuations of Chi, increasing regulation rigidity of diseased persons or simply to technical limitations of the method. Possibly new realtime Kirlian devices can provide additional information. (Treugut et al., 1998, p. 224)

Back in the 1970s, other authors emphasized that corona discharge photography is mostly explainable in conventional terms, unreliable, inconsistent, significantly susceptible to artifacts, and influenced by many interacting factors (Boyers & Tiller, 1973, 1976; Dakin, 1975; Krippner, 1979; Marino et al., 1979): for example, features of the device, exposure time, environmental variables, and physical properties of the tested object. As well as, for a living organism, its sweat and hydration level; roughness or smoothness; its degree of lipid concentration and deposited impurities; and the total area of the surface on which the corona discharge is induced. Therefore, they suggested that only by studying further and thoroughly this phenomenon, controlling all the major influencing factors, and developing standardized procedures, it might be possible to use Kirlian photography as a precise diagnostic tool.

Boyers & Tiller criticized the exaggerated conclusions being drawn about Kirlian photography, suggesting that only accurate research might reveal whether new forms of energy can be assessed with this technique:

> Extravagant claims are being made about the process based upon very little information. Of course, the fascinating color photographs of plant leaves and human fingertips would make anyone wax poetic (...). On the one hand, the intensity and character of the energy emissions seem to depend strongly on the mental, emotional, and physical health condition of the subject being photographed, and this has prompted some people to postulate new types of energy emission from the body (called bioplasmic energy by the Soviets). On the other hand, the process itself is clearly associated with an electrical discharge and looks, on the surface, like a corona discharge effect which has prompted other people to relegate the entire phenomenon to a category of fairly familiar electrical-discharge effects. Of course, both viewpoints may be correct in part; i. e., new energy forms embodying information about the living system may be manifest within the context and framework of the electrical-discharge phenomenon. To sort out this controversy will require careful experimentation under well-controlled conditions leading to completely reproducible results. Such a condition does not presently exist (...). (Boyers & Tiller, 1973, p. 3102)

Dakin noted that, while in some circumstances Kirlian images correlate with the body condition, they lack reproducibility and thus cannot be considered a reliable diagnostic tool:

> In special cases there are apparent correlations between the shape and intensity of high-voltage photographic images and physiological conditions. These correlations are not reliable or consistent. For that reason, high-voltage photography is of negligible value as a routine physiological monitoring technique for medical diagnostic or research applications. (Dakin, 1975, p. 66)

Krippner disagreed with the excessive mystification of this technique, which was attributed by some an occult connotation, and noted that such approach was discouraging serious researchers from investigating the true nature of this effect (1979). He commented:

> Although Kirlian photography someday may prove to be a tool in studying unusual phenomena (. . .), at the present time the process itself can be understood in reviewing the data on high voltage electricity and its properties. In other words, the Kirlian effect is highly complex. However, there does not seem to be any need to postulate exotic "energies" to explain the provocative, and in some cases exquisite, coronas produced. (Krippner, 1979, pp. 126–127)

Marino et al. concluded that Kirlian images reflect the moisture of the testee, relegating their usefulness to this specific function and reporting no evidence of other diagnostic applications:

> In summary, we found that Kirlian photographs mirror the moisture content and geometry of the object. We could find no evidence that the Kirlian aura, corona, or spectral distribution was related to the activity of either plant or animal cells. Our observations indicate that the potential of Kirlian photography as a diagnostic tool is limited to its possible development as an indicator of moisture content, or moisture distribution. (Marino et al., 1979, p. 53)

In the 1980s, other researchers criticized the Kirlian technique, highlighting its natural explanations and numerous artifacts, which would be sufficient to explain the features of the images (O'Regan, 1989; Watkins & Bickel, 1986).

Watkins & Bickel commented that there was no evidence yet to conclude that the characteristics of the Kirlian images were related to the psychophysiology of the testee:

> Moist fingers, varying pressures, different paper sensitivity, exposure and development times were responsible for most of the variations in the auras. *We conclude there is no need to evoke psychic phenomena to explain results and there is no evidence that psychic conditions affect the aura patterns* (...). There is no evidence as yet that any feature character or property of the aura pattern is related to the physiological, psychological, or psychic condition of the sample. (Watkins & Bickel, 1986, pp. 255–256)

O'Regan, speaking about the challenges and limitations of frontier science, reported the controversy surrounding Kirlian photography, where the divergences of opinion among scientists remained and did not resolve into a common truth (1989, pp. 248–249): While some criticized the technique as deeply flawed by artifacts, others continued to use it ignoring the critiques. O'Regan noted the difficulty of measuring very complex and noisy systems, such as living organisms, and the fact that too many variables affect Kirlian images to claim findings with it:

> Again, take Kirlian photography as an example. For some reason, fringe groups often like to show their intervention of choice "causing" changes in Kirlian images. But, as I mentioned earlier, the Kirlian process is a very noisy system. There are phenomenal numbers of variables from many, many different sources that can affect the image – as many as 200 of them according to the analysis by Faust et al. in their paper in *Science* in 1976. This is ideal for the operation of a kind of Rorschach process in the eye of the would-be investigator. If you wish to interpret, you see what you wish to see. It can be a very self-deluding thing. (O'Regan, 1989, p. 249)[2]

In the 1990s, Gadsby examined Kirlian photography, concluding that this technique can be explained through conventional science, but also recognizing its potential value for human bioenergetic assessment:

> The Kirlian phenomena then, appear to follow the existing laws of biophysics, and there appears no need to invent a new kind of law to explain the process, at least at this stage in our knowledge of the current paradigm (...). It may be too easy to take a single photograph which elegantly explains the patient's illness, and then to infer that other diagnostic Kirlian photographs may do likewise; this study suggests that we cannot make this observation routinely in the light of our current knowledge. Nevertheless there is mounting evidence, from this and other contemporary studies, that Kirlian diagnosis has an important part to play in patient energy analysis, within both orthodox and complementary therapies in medicine, and that more research in the future is indicated. (Gadsby, 1993, pp. 181–183)

Previous studies on the reliability of Kirlian photography devices returned overall negative results. The aim of this experiment is to perform a new reliability study on modern, up-to-date, and commercial devices, to evaluate whether and to which extent the conclusions of the previous studies are confirmed.

2 The mentioned publication by Faust et al. is Pehek et al. (1976).

Experiment Hypotheses

For this experiment, the following hypotheses were formulated:

1. It was hypothesized that the GDV device and the Bio-Well would show large measurement variability and high inconsistency in their assessments, at least in some of their parameters. In fact, previous studies on the same or similar technologies showed that fingertip electrophotonic emission is an unreliable physiological parameter, that can be explained mostly in conventional terms, and that commercial Kirlian-photography devices tend to return inaccurate and irreproducible results (Boyers & Tiller, 1973, 1976; Dakin, 1975; Gadsby, 1993; Jessel-Kenyon et al., 1998; Krippner, 1979; Marino et al., 1979; O'Regan, 1989; Shaduri, 2011; Treugut et al., 1998; Watkins & Bickel, 1986).
2. It was hypothesized that the healers' biofield, and their water energy field, would be affected by the Pranic Healing treatment, with a change in their parameters; while the non-healers' biofield, and their water energy field, would not be affected by the sham treatment, with no change in their parameters. Since the devices might not be entirely reliable in their assessments, nor very sensitive to subtle energy, a less neat result was anticipated. However, it was still expected that a larger variation would occur in the healers' biofield and water parameters compared to non-healers'.

Methods

Power Analysis

A power analysis was conducted to evaluate the variation of the Effect Size (ES) with the number of healers and water jars: This experiment was designed so that each healer would have an active water jar, to perform the treatment on, and a control water jar, they would be unaware of.

It was concluded that a sample size of 20 experienced Pranic healers would be feasible to reach, although it implied that only medium-large effect sizes could be potentially detected in the healers' biofield and water; however, this seemed reasonable given the expertise of the performers. During the trials, two healers could not be measured, since one had a missing finger (the software of the devices requires a full set of fingertips), while another had long synthetic nails, which created artifacts in the gas discharge images. Although their biofield could not be assessed, these two healers did perform the treatment on water and those data were included in the study.

For the human experiment, the power analysis was performed on a standard case, using a two-tailed dependent Student's t-test, with α (type-I error rate) = 0.05, Power ($1 - \beta$, β = type-II

error rate) = 0.80, and Cohen's d ES. With a group of 20 healers, the minimum ES that can be detected in their biofield, if an effect is really produced, is 0.66 (which increases to 0.70 for 18 healers).

For the water experiment, the power analysis was performed on a standard case as well, but using a two-tailed independent Student's t-test, with $\alpha = 0.05$, Power = 0.80, and Cohen's d ES. With a group of 20 healers, the minimum ES that can be detected in their water, if an effect is really produced, is 0.91.

Sample

The experiment thus involved 40 subjects: The active group included 20 Pranic healers, with an average experience of 11 years (SD = 6 years), while the control group consisted of 20 non-healers, i. e., people who did not practice any form of energy healing. The average participant age was 57 years (SD = 14 years). Participants were healthy or not suffering from life-threatening diseases. The sample was heterogenous, but populated on average by late middle-aged Caucasian women: In fact, the Caucasian ethnicity is predominant in California, where this experiment was carried out, and late middle-aged women seem more open to and versed in alternative medicine. The characteristics of active and control groups were comparable.

Experiment Procedure

The procedure of the experiment follows:

1. The GDV device and the Bio-Well were calibrated before each experiment and their optic glasses were cleaned before each experiment, as well as during the experiments, when the plastic filter was placed on or removed from the optic glass. The plastic filter, used to screen skin sweat, was changed for each set of repeated GDV-device measurements of each participant.
2. Participants were asked to come in with clean hands but not to wash them for at least 15 minutes prior to the experiment, so that their skin moisture would be in a normal state. They were also asked not to have a full stomach and bladder during the experiment, so that their physiology would be in a normal condition. The ambient temperature of the laboratory room was kept in a comfortable range, so that participants would feel at ease, neither cold nor hot, and thus their skin would be in a normal state. Healers were asked not to perform any subtle-energy treatment, meditation, breathing exercise, or spiritual activity on the day of the experiment, so that their pre-treatment condition would reflect their normal state.

3. Removal of rings, bracelets, and electronic devices, from the participants and investigator's body.
4. 3 measurements with the Bio-Well.
5. 3 measurements with the GDV device.
6. Healers placed their hands around a water jar, closed on top, and sent Prana to the water for 7 minutes, following the procedure reported in Appendix A. Non-healers placed their hands around a water jar, closed on top, and did nothing for 7 minutes. The geometrical shape of a circle was placed under the water jar and participants were instructed to keep their hands at that distance from the jar, i. e., 1 inch (~ 2.5 cm). A similar water jar, positioned in the laboratory room, but hidden from participants' sight and knowledge, was used as a control and changed for each experiment. The water bottles, to refill the jars, were kept in a different room.
7. 3 measurements with the GDV device.
8. 3 measurements with the Bio-Well.
9. Participants were engaged in the experiment for about 75 min.
10. In each experiment, 6 drops of water from the active jar and 6 drops from the control jar were GDV-tested, with the procedure described in Appendix B – the first drops of both jars were discarded and only 5 drops per jar were used for analysis, since initial data may be affected by instrumental errors. This part of the experiment was carried out without the presence of the participants in the laboratory room. The type of water chosen for this investigation was natural spring water – specifically, Arrowhead Mountain Spring Water.

Data Analysis

- The measurement variability was evaluated through the Intra- and Inter-Subject Variability (SV) or Water-Jar Variability (WJV), which were calculated using the Coefficient of Variation (CV): The CV is defined as the ratio between standard deviation and absolute value of the mean. The CVs for the Intra- and Inter-SV were computed using respectively each participant and all participants' data, while the CVs for the Intra- and Inter-WJV were computed using respectively each water jar and all water jars data. CV divergences, which occurred in some Intra-SVs of those device parameters that range through zero, were handled as follows: When the standard deviation and mean were both equal to zero, zero was taken as CV value, since that set of measurements was

constant; when the standard deviation was different from zero and the mean equal to zero, that set of measurements was discarded, since it was not possible to estimate a finite value for the CV.

- The normality of data distributions was checked with D'Agostino-Pearson, Shapiro-Wilk, and Anderson-Darling's tests, using a 5% threshold to define significance, i. e., non-normality. Only if all tests resulted non-significant, the distribution was considered normal.
- An equal-variance test was performed on distribution couples, to evaluate whether they were homoscedastic or heteroscedastic, for further analyses reported below. If distributions were normal, Bartlett's test was used, if they were non-normal, Levene's test (median-based version by Brown-Forsythe) was utilized, with a 5% threshold to define significance, i. e., heteroscedasticity. All distribution couples resulted to have equal variances.
- The correlation between distribution couples was calculated with Pearson's test, if they were normal, while Spearman's test was carried out, if they were non-normal.
- Null Hypothesis Significance Tests (NHSTs) were performed on distribution means: For dependent distributions, the dependent Student's t-test was used if they were normal, while the Wilcoxon signed-rank (W) test if they were non-normal. For independent distributions, the independent Student's t-test was used if they were normal, while Mann-Whitney (U) test if they were non-normal. Two distributions were considered dependent if the absolute value of their Correlation Coefficient (CC) was > 0.1. All tests were conducted on two tails, with a 5% threshold to define significance, i. e., rejection of the null hypothesis. Only two-tailed tests were used, which are more conservative, because this research was explorative.
- The Effect Sizes (ESs) of NHSTs were computed using Hedges' g.
- For normal distributions, parametric Confidence Intervals (CIs) were calculated as Standard Error (SE) multiplied by T statistic; for non-normal distributions, non-parametric CIs were calculated through the Bias-Corrected and Accelerated (BCa) Percentile Bootstrap method, with 10^5 iterations (resamples). 95% was chosen as probability coverage for all CIs.
- Statistical analyses were conducted using distributions with independent values, without replicates, so that each entry of each data set corresponded to a tested participant or water jar. The various device parameters, with their multiple components and measured repeatedly on participants or water jars, were averaged.
- Computer programming, specifically Python, was used to analyze the data, in accordance with the most rigorous and accepted guidelines.

The Coefficient of Variation and Other Methods

To assess the measurement variability of the GDV-device and Bio-Well parameters, the Coefficient of Variation (CV) was chosen, because it is commonly used in science for its simplicity and versatility (Abdi, 2010; Brown, 1998): Calculated as standard deviation over absolute value of the mean, it is intuitively understandable, dimensionless, and allows for an effective comparison among distributions with different units and means.

Other statistical approaches, such as those based on correlation coefficients, regression analyses, hypothesis tests on mean differences, or limits of agreement, were also considered (Altman & Bland, 1983; Bland & Altman, 1986; Bruton et al., 2000; Karras, 1997; Li et al., 2019; Zaki et al., 2012, 2013). However, these methods are not designed to compare the Inter- and Intra-SV, which seems important to determine the stability and usefulness of biophysical parameters. Therefore, they were excluded.

Moreover, using a correlation or regression approach may be misleading, because it would not be affected by a change of scale in the data, which however creates a gap between the readings and thus reduces their agreement: Two sets of measurements, multiplied by a certain factor or shifted by a certain quantity, would still result highly correlated and linearly related, despite their raw values may be in poor agreement – further analyses would have to be made to assess their real accordance, for example on slope and intercept. In fact, correlation measures the strength of association between two sets of scores, i. e., how much they vary together, but not the extent of their agreement, i. e., their degree of proximity. Besides, correlation is influenced by the variance of the data sets, resulting higher if the data range is larger, i. e., if the participant sample is heterogeneous, and lower otherwise. Additionally, common correlation and regression analyses are performed on two sets of observations, which was not this case – if subjects are measured more than twice, multiple coefficients would have to be calculated and averaged, or more complex models would have to be used.

A hypothesis test on the difference between distribution means would return a positive outcome in most cases (i. e., non-significant difference), showing that two or more data sets have similar means: This is likely to occur because they are a measurement of the same observable. However, such method would not help to define in detail the agreement between/among data sets in terms of individual readings, because it gives information about the differences between/among distribution means and not single measurements. Furthermore, a significance test is influenced by the power of the study.

The limits of agreement method is based on a simple graphical technique and the estimation of an interval, where the differences between pairs of readings are expected to lie with a certain probability – in the long run, a specific percentage of future differences between measurements

will fall within these limits. This method was originally developed to quantify the agreement between the measurements of two different clinical instruments, assessing the same variable, and not the reliability within the measurements of the same instrument. In this study, the former was evaluated through different approaches (i. e., inter-device correlation and Pranic Healing significance tests), while the latter was analyzed independently for each device through the CV.

Finally, the most common critique against the CV, claiming that very small means (close to zero) cause a divergence in its value, appears questionable: No divergence occurs, if the standard deviation is a fraction of the mean, as it should be in a reliable set of measurements, regardless of their values. For all these reasons, the CV seemed the most correct and appropriate choice to evaluate the measurement variability of these devices.

Results

Measurement Variability Analysis

In Tables 1 and 2, the Intra- and Inter-Subject Variability (SV) are reported for GDV-device human parameters, without and with filter, and Bio-Well human parameters.

GDV-Device Human Parameters					
		Without Filter		With Filter	
Parameter		Intra-SV [0.95 CI] (%)	Inter-SV (%)	Intra-SV [0.95 CI] (%)	Inter-SV (%)
Energy Field	Area	4.76 [3.94, 6.02]	11.1	3.15 [2.90, 3.45]	7.42
	Entropy	2.68 [2.44, 2.98]	4.94	3.18 [2.70, 4.67]	5.76
	Form Coefficient	9.50 [8.34, 10.7]	24.5	4.51 [4.05, 5.15]	10.2
	Symmetry	2.44 [1.77, 3.51]	6.20	0.67 [0.57, 0.79]	1.02
Organs	Activation Coefficient	29.0 [24.7, 33.7]		29.0 [24.7, 33.7]	
	Integral Area	199 [178, 219]		166 [142, 189]	
	JS	118 [79.6, 189]		74.8 [46.6, 139]	
	RMS	19.6 [17.2, 22.5]		18.8 [16.6, 21.0]	
	Integral Entropy	6.57 [5.91, 7.23]		7.94 [7.31, 8.71]	
Chakras	Energy Activity	222 [164, 338]		101 [70.9, 178]	
	Psychological Priority	196 [156, 315]		101 [92.4, 108]	

Table 1. Intra-Subject Variability (Intra-SV), with its 95% Confidence Interval (CI), and Inter-Subject Variability (Inter-SV) of GDV-device human parameters without and with filter – the Inter-SV is reported only for energy-field parameters, which were used in this research.

Bio-Well Human Parameters			
Parameter		**Intra-SV [0.95 CI] (%)**	**Inter-SV (%)**
Energy Field	Area	2.05 [1.87, 2.24]	5.85
	EC	1.70 [1.45, 1.94]	6.45
	FC	2.17 [1.90, 2.59]	6.99
	Balance	1.90 [1.67, 2.12]	2.25
	Energy	2.74 [2.52, 2.96]	8.66
Organs	Stress	3.89 [3.38, 4.58]	
	Area (C)	214 [190, 237]	
	Energy (C)	8.18 [7.86, 8.70]	
	Energy Balance	6.04 [5.70, 6.52]	
Chakras	Energy Value	3.98 [3.77, 4.24]	
	Alignment	6.44 [5.92, 6.96]	
	Asymmetry	358 [286, 469]	
Meridians	Energy Level	5.36 [5.05, 5.68]	

Table 2. Intra-Subject Variability (Intra-SV), with its 95% Confidence Interval (CI), and Inter-Subject Variability (Inter-SV) of Bio-Well human parameters – the Inter-SV is reported only for energy-field parameters, which were used in this research.

In most cases, energy-field parameters have smaller Intra-SV, compared to organ and chakra ones. The reason may be that energy-field parameters are calculated using multiple sectors, of Gas Discharge Images (GDIs), that are mapped around the contour of the body. Therefore, fingertip incorrect tilt or twist on the optic glass may not affect much the final outcome, because random variations in GDI sectors tend to cancel out reciprocally. Instead, most organ and chakra parameters are computed using individual GDI sectors, which are either uncombined or differently combined. This makes them more sensitive to fingertip positioning, so even slight misplacements of the fingertips can have a large impact on the results.

It should be considered that this experiment was conducted carefully, thus improper fingertip positioning could not have contributed so significantly to the large measurement variability observed in some organ and chakra parameters. However, the previous conclusions are still valid, if we identify a large and spontaneous variation in the fingertip gas discharges as the major factor determining the instability of those parameters. In such case, organ and chakra parameters would result more variable, because they are calculated out of specific GDI sectors, whose features tend to change from measurement to measurement; while energy-field ones

would result more stable because, when a multiplicity of GDI sectors are analyzed, random fluctuations tend to cancel out reciprocally.

In most cases, with-filter GDV-device parameters have smaller Intra-SV, compared to without-filter ones. This result seems due to the measurement procedure and the presence of the plastic filter on the optic glass, rather than to an informative bioenergetic phenomenon: In fact, the filter blurs out the features of the GDIs, decreasing their variability.

Energy-field parameters have small Intra-SV, but also small Inter-SV. This means that the stability of such parameters is influenced by the limited range of values that they can span: They tend to assume always the same set of values, regardless of the testees and their psychophysical condition, revealing a poor assessment capacity.

In Table 3, the Intra- and Inter-Water-Jar Variability (WJV) are reported, for GDV-device water parameters, which have small Intra-WJV but also small Inter-WJV. This indicates a narrow range of variation and thus limited utility.

GDV-Device Water Parameters		
Parameter	**Intra-WJV [0.95 CI] (%)**	**Inter-WJV (%)**
Area	2.24 [2.17, 2.31]	5.31
Entropy by Isoline	15.4 [14.2, 18.9]	23.5
Form Coefficient	4.77 [4.43, 5.80]	6.81
Spatial Fractality	3.38 [3.26, 3.50]	4.38
Average Intensity	1.19 [1.14, 1.26]	2.64
Mean Radius of Isoline	1.16 [1.14, 1.19]	2.86
Length of Isoline	4.97 [4.61, 6.04]	7.74

Table 3. Intra-Water-Jar Variability (Intra-WJV), with its 95% Confidence Interval (CI), and Inter-Water-Jar Variability (Inter-WJV) of GDV-device water parameters.

Correlation Analysis

In Table 4, the averages of the GDV-device and Bio-Well correlation analyses are reported. All analyses are reported in Appendix C. Results were calculated for human energy-field parameters and water parameters; and separately for all participants, healers, and non-healers, depending on the analysis.

Correlation Type	Device, Condition, and Group		CC [0.95 CI]
Human Intra-Device Correlation	GDV-Device Without Filter vs With Filter	All Participants Before	0.53 [0.36, 0.69]
		All Participants After	0.60 [0.37, 0.83]
	GDV-Device Without Filter Before vs After	Healers	0.87 [0.80, 0.94]
		Non-Healers	0.90 [0.85, 0.95]
	GDV-Device With Filter Before vs After	Healers	0.72 [0.59, 0.85]
		Non-Healers	0.70 [0.38, 1.0]
	Bio-Well Before vs After	Healers	0.67 [0.47, 0.74]
		Non-Healers	0.70 [0.34, 0.84]
Human Inter-Device Correlation	GDV-Device vs Bio-Well	All Participants Without Filter Before	-0.011 [-0.50, 0.47]
		All Participants Without Filter After	0.14 [-0.51, 0.78]
		All Participants With Filter Before	0.12 [-0.57, 0.36]
		All Participants With Filter After	0.058 [-0.65, 0.77]
Water Intra-Device Correlation	GDV-Device Control vs Active	Healers	0.22 [-0.013, 0.45]
		Non-Healers	0.42 [0.19, 0.65]

Table 4. Averages of GDV-device and Bio-Well correlation analyses. For each correlation type (human or water, intra or inter), device (GDV or Bio-Well), condition (without or with filter, before or after), and group (all participants, healers, or non-healers), the Correlation Coefficients (CCs), with their 95% Confidence Intervals (CIs), are reported.

In the human intra-device correlation, GDV-device parameters, without and with filter, show only a medium degree of correlation. However, the two types of measurement were taken consecutively on each testee, therefore a higher degree of correlation was expected. The GDV-device and Bio-Well parameters, before and after the Pranic Healing treatment (real or sham), respectively show a higher degree of correlation, as expected in a within-subjects design. Therefore, this result appears consistent.

In the human inter-device correlation, the shared GDV-device and Bio-Well parameters show uncorrelation on average, ranging from medium anticorrelation to medium-high correlation. Considering the similarity between the devices, a positive and high degree of correlation was expected between all their common parameters, if the two machines were reliable in their assessments.

In the water intra-device correlation, GDV-device parameters of control and active jars show non-negligible degrees of correlation. However, control and active jars should be independent on all parameters, with low degrees of correlation, as expected in a between-jars design.

Pranic Healing Analysis

In Tables 5 and 6, are reported the GDV-device and Bio-Well parameters, which showed statistically significant variations with a 5% *p*-value threshold, after the Pranic Healing treatment (real or sham). Results were calculated for human energy-field (before vs after) and water (control vs active) parameters, and separately for healers and non-healers.

Healers				
	GDV-Device / Bio-Well Parameter	**Before vs After (Human) Control vs Active (Water) Mean [0.95 CI]**	***P*-Value**	**ES [0.95 CI]**
Human Parameters	GDV-Device Area With Filter	25209 [24485, 25933] px vs 24411 [23683, 25139] px	2.88 E^{-03}	0.53 [0.0031, 1.1]
	GDV-Device Form Coeff. With Filter	13.1 [12.7, 13.5] vs 13.8 [13.3, 14.6]	2.33 E^{-03}	0.63 [0.34, 0.99]
	GDV-Device Symmetry With Filter	0.943 [0.941, 0.946] vs 0.940 [0.936, 0.944]	3.54 E^{-02}	0.48 [-0.045, 1.0]
Water Parameters	GDV-Device Entropy by Isoline	1.46 [1.38, 1.55] vs 1.33 [1.24, 1.40]	1.55 E^{-02}	0.71 [0.0046, 1.3]
	GDV-Device Average Intensity	110.7 [109.7, 111.7] px^{-1} vs 112.4 [111.5, 113.2] px^{-1}	1.69 E^{-04}	0.82 [0.28, 1.4]

Table 5. GDV-device and Bio-Well parameters, which showed statistically significant variations (*p*-value < 5%), in the healer group, after the real Pranic Healing treatment. The *p*-value, as well as the Means and Effect Size (ES) with their 95% Confidence Intervals (CIs), are reported for each parameter. Human energy-field parameters and water parameters were included in this analysis.

Non-Healers				
	GDV-Device / Bio-Well Parameter	**Before vs After (Human) Control vs Active (Water) Mean [0.95 CI]**	***P*-Value**	**ES [0.95 CI]**
Human Parameters	GDV-Device Area Without Filter	19741 [18786, 20696] px vs 20286 [19542, 21030] px	1.23 E^{-02}	0.29 [-0.19, 0.77]
	GDV-Device Area With Filter	23924 [23349, 24499] px vs 22793 [22215, 23372] px	1.32 E^{-07}	0.90 [0.34, 1.5]
	GDV-Device Entropy Without Filter	3.67 [3.60, 3.75] vs 3.62 [3.56, 3.68]	3.34 E^{-03}	0.36 [-0.12, 0.85]
	GDV-Device Form Coeff. Without Filter	22.5 [20.4, 24.9] vs 20.7 [19.2, 22.8]	5.86 E^{-04}	0.36 [0.20, 0.60]
	GDV-Device Form Coeff. With Filter	13.9 [13.5, 14.4] vs 14.7 [14.1, 15.3]	1.94 E^{-05}	0.68 [0.16, 1.2]
	GDV-Device Symmetry Without Filter	0.901 [0.866, 0.919] vs 0.925 [0.904, 0.934]	1.03 E^{-04}	0.53 [0.27, 0.79]
	GDV-Device Symmetry With Filter	0.946 [0.942, 0.948] vs 0.941 [0.938, 0.944]	1.21 E^{-02}	0.61 [0.067, 1.1]
Water Parameters	GDV-Device Average Intensity	110. 9 [110.0, 111.8] px^{-1} vs 112.6 [111.7, 113.4] px^{-1}	1.05 E^{-04}	0.88 [0.33, 1.4]

Table 6. GDV-device and Bio-Well parameters, which showed statistically significant variations (p-value < 5%), in the non-healer group, after the sham Pranic Healing treatment. The p-value, as well as the Means and Effect Size (ES) with their 95% Confidence Intervals (CIs), are reported for each parameter. Human energy-field parameters and water parameters were included in this analysis.

More human parameters of the non-healers show statistical significance compared to those of the healers, while no Bio-Well parameter shows significance in either group. However, a different result was expected, with both devices: Healers, who performed an energetic treatment, were supposed to show larger variations in their biofield than non-healers, who did not.

Two water parameters of the healers show statistical significance compared to only one of the non-healers, which could be interpreted as a mild positive result.

Discussion

Measurement Variability Analysis

The analysis of the human measurement variability shows that energy-field parameters have smaller Intra-Subject Variability (Intra-SV) (CV ~ 10^0), compared to organ and chakra ones, which appear more variable (CV ~ 10^0–10^2). This result seems due to poorly controllable factors, such as fingertip positioning by the testee and the electrophotonic emission itself. These factors tend to impact more significantly on those parameters that are calculated out of individual sectors of the Gas Discharge Images (GDIs), where random variations do not cancel out with those of other sectors.

It should be pointed out that correct fingertip placement has to be taught to the testee before measurement and checked by the experimenter during measurement – by looking at the GDIs that appear on the computer screen as they are being taken. Therefore, the experimenter has to deduce whether a fingertip has been correctly placed by the testee on the optic glass, based on the corona discharge shape and location on the digital snapshot; but cannot directly see the testee's fingertip, which is covered to screen out environmental light. This seems to be an important limitation of Kirlian photography devices, because a reliable diagnostic device should not rely on the capacity of the testee to get tested.

Moreover, it should be reported that, in a few cases, participants with normal-range or slightly-longer nails produced some small artifacts on the GDIs, despite the best efforts of the participants and experimenter to avoid them. In this experiment, it can be assumed that a systematic artifact did not affect the results, because the purpose of the study was to evaluate measurement variability and detect bioenergetic changes due to an intervention. However, in cases where the goal is to assess the health status of a testee, such artifact would distort the results to some extent: A sector of the corona discharge would be altered with an impact on its parameters, which may not reflect the real health status of the organism and specific organs. Therefore, potential nail artifacts should be identified and avoided, whenever possible and as much as the morphology of the testee's fingertip allows. Besides, if very short nails are needed to always ensure clean and accurate measurements, this caveat should be clearly specified by the device inventors in their publications. Finally, editing out nail artifacts from the images may not always guarantee a perfect result, because the glow of the nail partly overlaps with that of the fingertip.

In most cases, with-filter GDV-device parameters show less variability compared to without-filter ones, which can be seen also visually: Filtered GDIs are generally fuller, denser, smoother, with less gaps, and thus less detailed, than unfiltered ones. This result seems consis-

tent with the finding that skin moisture is the principal determinant in the variability of human corona discharge images (Pehek et al., 1976), which are therefore more stable when palmar perspiration is screened out.

These findings also suggest that calibrating the devices with an inanimate object (metal cylinder) may not be a realistic reproduction of a human fingertip measurement, where the variability of some parameters results much larger than expected. Moreover, the shape and dimension of the calibration cylinder are always the same, while those of a human fingertip can vary, depending on the characteristics of the testee. Therefore, defining the optimal ranges through this method may be inaccurate and adjusting them complicated.

When the Inter-Subject Variability (Inter-SV) is taken into account, further evaluations can be made about the reliability of these machines, since those parameters which have small Intra-SV, i. e., the energy-field ones, also have small Inter-SV. Considering only the GDV-device and Bio-Well energy-field parameters, it turns out that the average Intra-SV is 3.19% and the average Inter-SV is 7.79%, which is only 2.45 times larger (here and throughout the discussion, raw unrounded numbers were used for calculations). Although physiological parameters can have a limited range of variation, when this is too narrow, it may be an indication that they are not very person- and condition-specific, and thus that they have a poor informative and diagnostic value. Instead, an accurate and reliable parameter should be able to span a large range of values, depending on the testees and their psychophysical condition (large Inter-SV); but it should return similar values when the same subject is tested repeatedly in the same psychophysical condition (small Intra-SV).

In the analysis of the water measurement variability, parameters resulted to be overall stable, similarly to the human energy-field ones. However, they have a very small ratio between Inter-Water-Jar Variability (Inter-WJV) and Intra-WJV, with an average of 1.61, which makes their usefulness questionable.

The analyses of the human and water measurement variability are only partially in agreement with Korotkov's studies on his Kirlian photography devices (2002). In fact, the scientist claims that, for most people measured in the same psychophysiological state, human parameters vary no more than 10%, from hour to hour or even day to day, and draws similar conclusions about the liquid parameters: He thus suggests that his technologies are reliable for research and clinical purposes. However, the results of this investigation seem more complex. While it is true that some parameters are stable, with a small Intra-SV/WJV (less than 10%), it should also be considered that they have a small Inter-SV/WJV, which was not taken into account by Korotkov and puts to question their usefulness. Other parameters instead show a much larger Intra-SV, which makes them unstable and unreliable.

It may be argued that, in this experiment, the energy-field parameters of Korotkov's devices resulted stable, with a small measurement variability, unlike Shaduri's totally negative results (2011). However, it should be noted that Shaduri analyzed the details and signatures of the GDIs: The instability she reports seems consistent with the large variability, found in this study, of some organ and chakra parameters, which are calculated out of specific GDI sectors. Besides, in this research, GDIs were not visually inspected in their original form, but they were processed by the software of the devices, which calculates and returns their parameters. As previously explained, the energy-field parameters are computed based on multiple GDI sectors, thus potential discharge variations tend to cancel out reciprocally. Additionally, the small Inter-Subject Variability (Inter-SV) of such parameters, which seems to be set by the software, tends to limit even more their variation.

In subsequent analyses, only the GDV-device and Bio-Well energy-field parameters were taken into account, because they resulted to be more stable and they are allegedly reflective of the testee's whole energy field; all water parameters were included, because they resulted to be stable. The reason why the Coefficient of Variation (CV) was chosen over other methods, to evaluate measurement variability, was previously explained and its most common critique addressed. While it is true that, in this analysis, the parameters ranging through zero show larger CVs on average, there are also cases where their CVs, for individual participants, organs, and chakras, are small or acceptable, for example within 10, 20, or 30%; although such events are not frequent. Besides, it should be noted that the GDV-device and Bio-Well parameters used in this research are the energy-field and water ones, which do not range through zero, since they are positive and non-null.

Correlation Analysis

The analysis of the human intra-device correlation, between GDV-device parameters without and with filter, shows only a medium degree of correlation (CC ~ 0.57), although the two types of GDI were taken within a few-minute time lapse – once all fingertips are tested without filter, the measurement is immediately repeated using the filter. When the correlation analysis is performed on GDV-device and Bio-Well parameters respectively, between before and after the Pranic Healing treatment (real or sham), a higher degree of correlation appears (CC ~ 0.76, up to 0.93 for non-healers); this may be considered as a positive sign of measurement consistency. However, in the correlation analysis of GDV-device water parameters, which will be discussed soon, supposedly uncorrelated physical systems appear correlated, which puts to question the data elaboration of the machine.

In the analysis of the human inter-device correlation, some of the shared GDV-device and Bio-Well parameters resulted uncorrelated or moderately correlated, while others anti-cor-

related to some extent, which is alarming (CC ~ 0.076, down to -0.57). In fact, even though the Bio-Well is supposed to be an advancement of the GDV device, with a more sophisticated hardware and software, both machines share the same principle of working. Therefore, their degree of correlation should be positive and high, considering also the short time frame between their use on the testees. Such results could be explained through the variability of the fingertip corona discharge, as well as the inconsistency of the two measuring devices.

The analysis of the water intra-device correlation shows that, in several cases, control and active water parameters have non-negligible degrees of correlation (CC ~ 0.32, up to 0.69 for healers), although control and active water should be independent and thus poorly correlated. Such phenomenon suggests that the GDV-device water software may create correlation patterns between uncorrelated physical systems. In fact, while control and active water came from the same bottle and were kept in the same ambient conditions, their correlation seems excessively high on several parameters. This puts to question the very purpose of a control in GDV-device water experiments, as well as the measurement of human energy-field parameters, whose software is different but whose calculation is similar. Besides, even if control and active water were supposed to be correlated to some extent, it is unclear why not all their parameters are. However, these inconsistent correlations may also be due to the small sample size and should be reanalyzed in larger experiments.

Pranic Healing Analysis

The Pranic Healing analysis of human parameters shows that non-healers, who did not perform any bioenergetic practice in-between their fingertip discharge measurements, went through even more and larger variations than healers, who actually performed the treatment: 7 vs 3 statistically significant parameters, with p-values down to 10^{-7} and effect sizes up to 0.90. Therefore, it can be hypothesized that Korotkov's technologies and measurement procedures may not allow to correctly assess changes in the human subtle energy system, if they occur; and/or that fingertip electrophotonic emission may not be an adequate biophysical indicator of subtle energy changes in the human body; or that fingertip electrophotonic emission and Kirlian photography may be too variable to be used as a bioenergetic-assessment tool of any sort.

Besides, there is no consistency between the shared GDV-device and Bio-Well parameters, which did not show a similar statistical significance: No Bio-Well energy-field parameter resulted significant, compared to many GDV-device ones that passed the significance threshold. This highlights a much lower sensitivity of the Bio-Well to human bioenergetic changes, compared to the GDV device. It may be argued that the Bio-Well measurements were taken as

first and last, thus being more distant from the Pranic Healing treatment (real or sham). However, this does not seem to be a sufficient justification for the complete absence of statistically significant Bio-Well parameters, compared to many similar GDV-device ones.

The Pranic Healing analysis of water parameters proved to be inconclusive as well: Although two parameters of the healers resulted significant compared to only one of the non-healers, this finding does not seem to be remarkable. In fact, the non-healers' active water, where no bioenergetic intervention was made, still showed a statistically significant change compared to the control, which puts to question also the healers' results. Moreover, the small Inter-WJVs and high Correlation Coefficients (CCs) of water parameters cast doubt on how they are calculated by the software. However, the GDV-device water testing may be relatively more reliable than the human one, because an inanimate substance is less variable than a living being and the measurement procedure depends only on the experimenter.

Limitations

All participants' information was self-declared: age, health, and physiological status; experience with Pranic Healing practice and non-practice on the experiment day; as well as non-experience with any energy healing modality.

Frequentist statistics was used for data analysis. The customary thresholds for type-I and type-II errors ($\alpha = 0.05$, $\beta = 0.20$) were chosen for Null Hypothesis Significance Testing (NHST) on means. Effect Sizes (ESs) were included with their Confidence Intervals (CIs), which were reported also for Means and Correlation Coefficients (CCs). CIs are often large and ESs below the threshold of statistical significance, which was estimated through the power analysis and resulted relatively high: This was primarily due to the limited sample size, determined by the choice to have an active group of experienced Pranic healers.

Conclusion

In this research work, the functioning of two biofield machines, the Gas Discharge Visualization (GDV) device and the Bio-Well, as well as the concept of life force, specifically Prana, were presented and analyzed. An in-depth investigation into the reliability of Kirlian photography was conducted, comparing the results with previous studies. In this way, it was possible to evaluate the strengths and limitations of these technologies, and contextualize the experiment results.

The GDV technique is based on the holographic principle that the body is mapped in its pieces, which thus carry valuable diagnostic information that can be measured through technology. However, these Kirlian photography devices did not result reliable at capturing the

fingertip and water electrophotonic emission, and at evaluating energetic changes due to Pranic Healing. Based on these results, the GDV device and the Bio-Well do not seem to be accurate and reliable tools for biofield science, therefore the scientific literature and findings regarding these machines should be questioned. In fact, as found also by others, commercial devices and standard testing procedures seem to return highly variable imagery, with substantial artifacts and questionable informative value (Boyers & Tiller, 1973, 1976; Dakin, 1975; Gadsby, 1993; Jessel-Kenyon et al., 1998; Krippner, 1979; Marino et al., 1979; O'Regan, 1989; Shaduri, 2011; Treugut et al., 1998; Watkins & Bickel, 1986). Therefore, an improvement in technology and measurement protocol is needed to make Kirlian photography a reliable tool for biofield science.

Ethics

The investigator declares that he conducted this research with rigor, utilizing the GDV device and the Bio-Well as indicated by the inventor. This study was approved by the BioMed IRB (Biomedical Research Institute of America): This non-profit and independent Institutional Review Board is committed to protecting human research subjects, by maintaining the highest ethical standards. All participants received and signed an informed consent. The experiment was self-funded by the investigator. Participants were not financially compensated for joining the experiment, but were given as a gift the health report returned by the devices.

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Appendix A

Procedure for Energizing Water with Prana through the Double Parallel Energizing Technique

1. Do 5 rounds of 6-3-6-3 Pranic breathing (inhale for 6 beats, hold breath for 3 beats, exhale for 6 beats, hold breath for 3 beats; this is one round).
2. Simultaneously calm and still the mind.
3. Activate the hand chakras.
4. Place the energized palms parallel to each other around the water jar.
5. Begin energizing the water by willing and directing white Prana into the water.
6. Simultaneously continue 6-3-6-3 Pranic breathing for 7 minutes.
7. Maintain focus on the hand chakras and on directing Prana into the water during the 7 minutes.
8. When 7 minutes have lapsed, you will be notified: Stop the double parallel energizing technique and withdraw the hands from the water jar.
9. Do 5 more rounds of 6-3-6-3 Pranic breathing to avoid a possible depletion of the energy body.

Appendix B

Procedure for Testing Water Drops with the GDV Device

1. Calibration of the GDV device and set up of the water kit on the optic glass.
2. In the GDV software, select the following options:
   (a) Time length: 24 seconds, (b) Frame rate: 5 frames per second.
   This means that 120 images of a drop are captured in one series.
3. Use new tuberculin syringes each time a new drop is tested and clean the optic glass each time as well:
   1. Fill the syringe with the water from the jar.
   2. Dry the edges of the syringe.
   3. Make sure there is only a little water coming out of the syringe tip (just a small meniscus).
4. Measure 6 drops of each jar.
5. For each drop, record 2 captures, i. e., 2 series of 24 seconds each.
6. For statistical analysis, discard the first drop and use only images from 21 to 120 of the other drops – initial data may be affected by instrumental errors.

Appendix C

Correlation Analyses

Human Intra-Device Correlation

Table 1 shows the Correlation Coefficients (CCs) between GDV-device parameters without and with filter: CCs were calculated for data before and after the Pranic Healing treatment (real or sham), and for human energy-field parameters of all participants. Only a medium degree of correlation appears.

GDV-Device Without vs With Filter Human Parameters All Participants		
Parameter	**Before CC [0.95 CI]**	**After CC [0.95 CI]**
Area	0.59 [0.31, 0.78]	0.65 [0.29, 0.84]
Entropy	0.53 [0.25, 0.72]	0.77 [0.60, 0.88]
Form Coefficient	0.61 [0.31, 0.81]	0.57 [0.27, 0.76]
Symmetry	0.38 [0.060, 0.62]	0.43 [0.059, 0.69]

Table 1. Correlation Coefficients (CCs), with their 95% Confidence Intervals (CIs), between GDV-device parameters without and with filter, before and after the Pranic Healing treatment (real or sham). Human energy-field parameters of all participants were included in this analysis.

Tables 2 and 3 show the CCs of GDV-device and Bio-Well parameters between before and after the Pranic Healing treatment (real or sham): CCs were calculated for data without and with filter, and for human energy-field parameters of healers and non-healers separately. A higher degree of correlation appears.

GDV-Device Before vs After Human Parameters				
	Healers		**Non-Healers**	
Parameter	**Without Filter CC [0.95 CI]**	**With Filter CC [0.95 CI]**	**Without Filter CC [0.95 CI]**	**With Filter CC [0.95 CI]**
Area	0.89 [0.73, 0.98]	0.78 [0.49, 0.91]	0.91 [0.79, 0.96]	0.87 [0.70, 0.95]
Entropy	0.91 [0.76, 0.96]	0.80 [0.24, 0.97]	0.90 [0.76, 0.96]	0.49 [-0.12, 0.85]
Form Coefficient	0.89 [0.72, 0.96]	0.66 [0.22, 0.89]	0.93 [0.85, 0.98]	0.86 [0.67, 0.94]
Symmetry	0.80 [0.57, 0.95]	0.64 [0.24, 0.85]	0.85 [0.53, 0.96]	0.57 [0.062, 0.82]

Table 2. Correlation Coefficients (CCs), with their 95% Confidence Intervals (CIs), of GDV-device parameters without and with filter, between before and after the Pranic Healing treatment (real or sham). Human energy-field parameters of healers and non-healers were included in this analysis.

Bio-Well Before vs After Human Parameters		
	Healers	Non-Healers
Parameter	CC [0.95 CI]	CC [0.95 CI]
Area	0.71 [0.36, 0.88]	0.82 [0.59, 0.92]
EC	0.77 [0.48, 0.91]	0.91 [0.80, 0.98]
FC	0.71 [0.28, 0.89]	0.72 [0.35, 0.90]
Balance	0.41 [-0.11, 0.73]	0.22 [-0.25, 0.60]
Energy	0.76 [0.45, 0.90]	0.82 [0.59, 0.93]

Table 3. Correlation Coefficients (CCs), with their 95% Confidence Intervals (CIs), of Bio-Well parameters, between before and after the Pranic Healing treatment (real or sham). Human energy-field parameters of healers and non-healers were included in this analysis.

Human Inter-Device Correlation

Table 4 shows the Correlation Coefficients (CCs) between the shared parameters of the GDV device – without and with filter – and the Bio-Well: CCs were calculated for data before and after the Pranic Healing treatment (real or sham), and for human energy-field parameters of all participants. Uncorrelation, moderate correlation, or even some degree of anti-correlation appear.

Human Parameters All Participants				
	Before		After	
Parameter	GDV-D. Without Filter vs Bio-Well CC [0.95 CI]	GDV-D. With Filter vs Bio-Well CC [0.95 CI]	GDV-D. Without Filter vs Bio-Well CC [0.95 CI]	GDV-D. With Filter vs Bio-Well CC [0.95 CI]
Area	0.39 [0.064, 0.64]	0.41 [0.092, 0.65]	0.61 [0.39, 0.76]	0.63 [0.37, 0.80]
Entropy (EC)	-0.067 [-0.40, 0.29]	0.37 [0.033, 0.63]	0.00011 [-0.34, 0.35]	-0.017 [-0.34, 0.32]
Form Coefficient (FC)	-0.35 [-0.65, 0.061]	-0.57 [-0.76, -0.22]	-0.34 [-0.64, 0.082]	-0.46 [-0.69, -0.13]
Symmetry (Balance)	-0.012 [-0.37, 0.35]	0.26 [-0.086, 0.55]	0.28 [-0.071, 0.56]	0.069 [-0.26, 0.37]

Table 4. Correlation Coefficients (CCs), with their 95% Confidence Intervals (CIs), between the shared parameters of the GDV device – without and with filter – and the Bio-Well, before and after the Pranic Healing treatment (real or sham). Human energy-field parameters of all participants were included in this analysis.

Water Intra-Device Correlation

Table 5 shows the Correlation Coefficients (CCs) of GDV-device water parameters, between control and active jars: Results were calculated separately for healers and non-healers. In several cases, non-negligible degrees of correlation appear.

GDV-Device Control vs Active Water Parameters		
	Healers	**Non-Healers**
Parameter	**CC [0.95 CI]**	**CC [0.95 CI]**
Area	0.30 [-0.17, 0.65]	0.67 [0.32, 0.86]
Entropy by Isoline	0.077 [-0.35, 0.53]	0.33 [-0.19, 0.71]
Form Coefficient	-0.056 [-0.46, 0.38]	0.14 [-0.33, 0.56]
Spatial Fractality	0.0075 [-0.46, 0.43]	0.095 [-0.36, 0.52]
Average Intensity	0.69 [0.35, 0.87]	0.66 [0.31, 0.85]
Mean Radius of Isoline	0.26 [-0.20, 0.63]	0.66 [0.31, 0.85]
Length of Isoline	0.24 [-0.24, 0.60]	0.39 [-0.064, 0.71]

Table 5. Correlation Coefficients (CCs), with their 95% Confidence Intervals (CIs), of GDV-device water parameters, between control and active jars, for healers and non-healers.