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TECHNICAL NOTE

DISCUSSION ON METHODOLOGY OF WATER CRYSTAL FORMATION AS A DETECTION SYSTEM FOR PSI

By Hideyuki Kokubo, Yasuyuki Nemoto,* and Kimiko Kawano

ABSTRACT: It is often claimed that the form of a water crystal can be changed by human intent although there are few scientific studies that have tested this claim. In 2006, several researchers published the first scientific report which shows positive results for the claim. Recently, the authors have also considered this issue. Unexpectedly, they found two serious weak points in the conventional test procedure for water crystal formation. One of the points relates to the use of judgement, and the other relates to sample size. These points did not seem easy to find, and the authors were concerned that many researchers may fall into the trap laid by these points. In the present paper, the authors discuss these methodological problems of conventional tests, and indicate that photographs of water crystals are not independent parameters and that the numbers of water bottles used are too few to conclude something statistically.

Keywords: water crystal formation, morphological, intent, psi

Liquid water is an excellent solvent which can dissolve a multitude of substances, and it also has important roles in life activities. For example, about 70% of the human body is water, and humans cannot live without water. Water is an important substance for all living creatures on the earth.

In research on ki (qi) and parapsychology, there are studies suggesting that water relates essentially to the nature of anomalous phenomena. For example, Kataoka, Sugiyama, & Matsumoto (1997a, 1997b) reported the results of examining human neutrophils, a kind of leukocyte. After a healer gave his "power" to a water solution (phosphate-buffered saline (PBS), pH 7.4), the solution was given to human neutrophils. It was found that the calcium ion channel on the cell membrane of the neutrophils was opened and phagocytosis was activated. In contrast, the control solution (without the healer's power) did not activate the calcium ion channel nor phagocytosis. Moreover, Sasaki, Sako, and Kobayashi (1993) reported that a qigong master gave his power to water samples and the conductance of the samples changed anomalously during 17 days of measurements. In these studies, healers merely gave their power to water (without any intent to cause a certain phenomenon). These studies suggest that water has a specific property to retain anomalous effects. However, what kinds of mechanisms cause this retention have not been studied yet.

Recently, in chemistry and biosciences, some researchers have reported interesting and strange properties of water. For example, Algara-Siller et al. (2015) reported high-resolution electron microscopy images of water locked between two graphene sheets, an archetypal example of hydrophobic confinement. Their observations showed that the nanoconfined water at room temperature forms "square ice"—a phase having symmetry qualitatively different from the conventional tetrahedral geometry of hydrogen bonding between water molecules. Pollack (2013) found that if liquid water contacted the surface of a hydrophilic material, a special zone of water was formed near the surface. He claimed that it was the fourth phase of water, which was different from solid, liquid, and gas phases. Montagnier et al. (2011) reported that liquid water has an ability to retain DNA information. These studies suggest the possibility to expand consideration of water and to explain ki or psi phenomena scientifically.

On the other hand, as researchers know well, practitioners of healing and qigong often claim that liquid water shows a special responsiveness to ki or psi. For example, the taste of drinks can be changed

if the practitioners give their power to them. Moreover, Emoto (1999) published the photo book *Messages from Water*, claiming that if a person writes phrases such as "love and gratitude" on a paper and attaches the paper to a bottle containing water, water crystals will take special forms. However, these claims are anecdotal and subjective and are insufficient as evidence from the viewpoints of modern science. If researchers want to discuss their claims as scientific hypotheses, experimental studies are needed, for example, to measure the change of measurable parameters (pH, components of foods and drinks, radius of particles, temperature, etc.). Moreover, researchers have to start from a basic hypothesis that anomalous formulation of water crystals can be caused by intent directly, before claiming that anomalous effects also can be caused by written letters. Radin, Hayssen, Emoto, and Kizu (2006) tested water crystal formation in such a basic study and reported that human intent can affect water crystal formation. They tried to replicate the first result in another test (Radin, Lund, Emoto, & Kizu, 2008), but they were unsuccessful. Their attempt stimulated the present authors to look at the anomalous formation of water crystals.

The authors changed the methodology partially and tried to construct a new experimental system which is less ambiguous. The authors tested water crystal formation using a new way of making water crystals. They used two experimental bottles and two control bottles in the same way as in the previous studies. Also they executed two blank tests using two blank-experimental bottles and two blank-control bottles. They took 50 photographs of water crystals for each bottle. A total of 400 photographs were scored by 38 judges from a morphological viewpoint. The authors expected to obtain significant results similar to those of the previous studies. However, unexpectedly, they found two serious weak points in the conventional procedure and concluded that all studies (including their new tests) should be considered as preliminary. One of the points relates to the use of judgement, and the other relates to sample size. These points did not seem easy to find, and the authors were concerned that many researchers may fall into the trap laid by these points. In the present paper, the authors discuss these methodological problems, and they note that photographs of water crystals are not independent parameters and that more experiments are needed to conclude something statistically.

Basic Method

The basic test procedure for assessing water crystal formation, which was adopted by Radin et al. (2006), can be summarized as follows. Human intent is applied to a water-filled bottle for an experiment. Next, paired experimental and control bottles are given to an operator. The operator prepares Petri dishes in which the water crystals are formed, and he or she photographs them the next day.

The work of preparing the dishes is done for each bottle. The operator takes water from a bottle using a syringe; next he puts 1 mL of the water into a Petri dish; then each dish is covered by a lid. In all, 50 sample dishes are prepared from each bottle. The Petri dishes are piled up on a plate and then put into a freezer (-20 degrees Celsius) as shown in Figure 1. The frost in the freezer is removed before the experiment. The temperature of the freezer, which is located in a cold walk-in room, is set to -5° Celsius. After the dishes are in the freezer for about 24 hours, the operator takes their photographs in the low-temperature room using a camera setup.

The operator takes a dish from the freezer, removes the lid, sets it on a microscope, and photographs the dish immediately (Figure 2). The microscope used is a metallurgical microscope (model BX51, Olympus Corp.) with an objective lens (LMPlanFl 20x, Olympus Corp.), and the sample is illuminated from above. Photographs are taken using a digital camera (EOS 6D, Cannon Inc.) with an adapter (NY1S-35, Microscope Network Co., Ltd.) to allow attachment to the ocular tube of the microscope. About 10 s are needed to take the dish from the freezer and take a photo. After taking the photo, the sample is discarded, and the next sample is photographed.

On following days, the operator prepares sample dishes from another bottle and repeats the procedure as given above.

After all samples have been photographed, the photographs are grouped according to which sample bottle the dishes came from. The operator then passes them to the researchers who provide them to the judges.

The photographs are scored by judges on an aesthetic basis. If the ratings of the experimental photographs are higher than those of the control photographs, it is concluded that human intent can influence water crystal formation.

On the surface, this method seems suitable to detect anomalous effects of human intent. However, a few important points must be considered in order to confirm that this method is truly suitable.

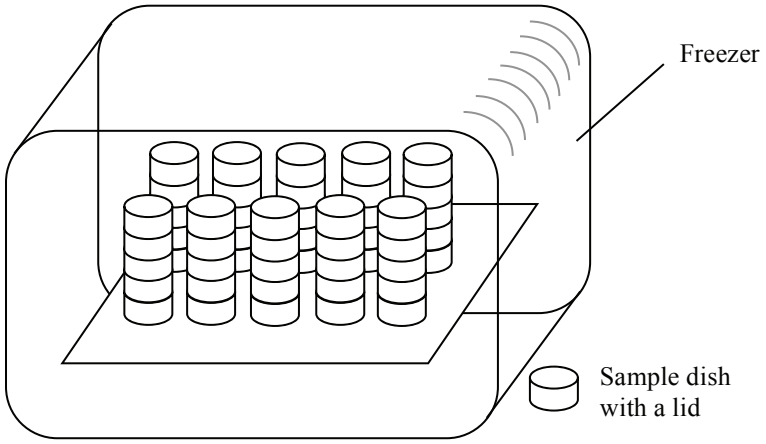


Figure 1. Arrangement of sample dishes during freezing.

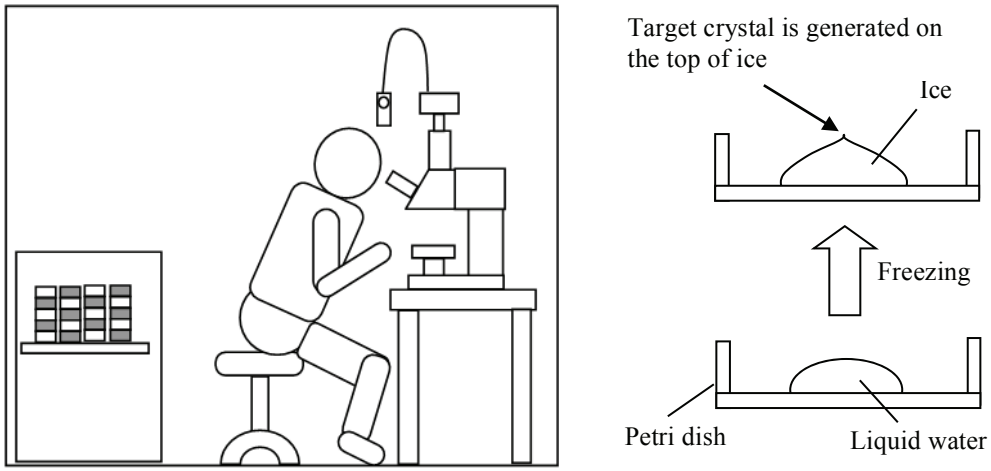


Figure 2. Low-temperature room setup for photography. Several delicate techniques are needed to freeze liquid water to ice having a desirable form, and the I.H.M. laboratory has developed such techniques. Therefore, usually researchers pass their sample water bottles to the I.H.M., where operators photograph the water crystals.

Key Points of Method

Dishes and Phtographs Are Not Independent

One of the key points of this method is that the 50 dishes of water crystals are not independent of one another. Therefore, all dishes are influenced by the same natural fluctuation in the process of freezing and microscopic observation. If the natural fluctuation tilts in a "good" direction, many "good" crystals will be formed. Conversely, many "bad" crystals will be formed if the natural fluctuation tilts in a "bad" direction. The numbers of "good" crystals fluctuate naturally for freezing and observation under the microscope

(Figure 3). Natural fluctuation includes system biases such as humidity, atomospheric pressure, and degree of skill of operators. If an operator fails to freeze water samples for unexpected reasons, all water crystals will become "bad"

Usually, 50 photographs are taken in one experimental period from one sample bottle by one overnight freezing operation. The distribution of rating scores depends on the operation. In other words, the operations or sample bottles are the true independent parameters. It may seem that there are 50 independent photographs, but they are actually derived from one datum.

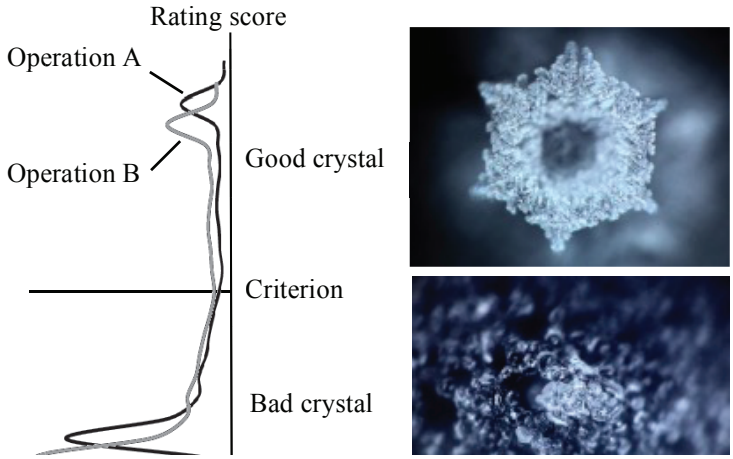


Figure 3. Conceptual distribution of ratings of photographs.

Many Blank Tests Are Needed

Another key point is the number of sample bottles. If researchers want to examine whether an experimental sample bottle shows anomalous effects or not, they should execute many blank tests and estimate the distribution of rating scores of the population of blank tests in advance (Figure 4). The blank test is the experiment to test water crystal formation using water samples without special treatments. Although details of the properties of the population of blank tests are not yet known, the authors expected the *SD* of the blank tests to be relatively large based on the authors' test experiences (details are shown in the next section). Therefore, small numbers of sample bottles are not enough to test for an anomaly statistically. For example, the six bottles in the study by Radin et al. (2008) do not provide useful measures of variability among bottles. They used a hierarchical model that had a factor for each bottle and thus in theory adjusted for differences among bottles. However, only six bottles do not provide a good estimate of variatiability among bottles.

Role of Judges

An additional explanation may be needed for some readers who think that anomalous effects can be detected even from data such as those shown in Figure 3 if many judges are used. It would be correct if we want to know which drawings A or B are liked by people. Many people vote, and then we would be able to discuss a result. If there were many judges, the objectivity of the judgements would increase. However, if we want to know which condition is more effective in forming water crystals, we should compare many data pairs of different conditions. Although a huge number of judges improves the objectivity of the rating scores, the statistical significance between conditions depends on the number of sample bottles. It is impossible to discuss the difference between test conditions statistically if we use only one pair of sample bottles, even if we use many judges.

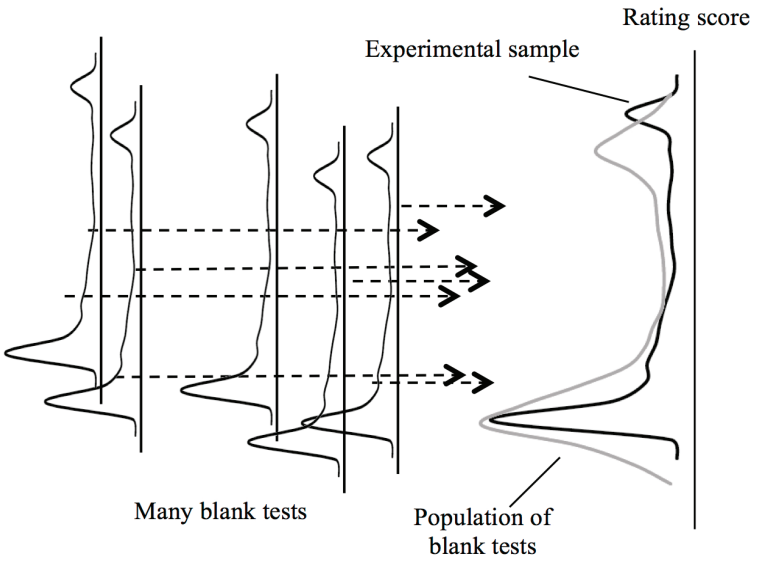


Figure 4. Many blank tests are needed to estimate experimental samples.

Authors' Experiment

In the above sections, the authors discussed methodological problems in conventional tests on water crystal formation. However, those problems seem to be difficult to find if researchers read Radin's papers only. The reason is that many researchers have not experienced such tests and do not have basic knowledge of their properties. In fact, the authors had not succeeded in finding these problems until they did similar tests themselves. In doing their tests, they found the methodological problems mentioned above.

In 2013, H.K., one of the authors, visited the I.H.M. General Institute and had an opportunity to inspect the whole process of photographing water crystals. Following this, H.K. discussed with Y.N., one of the authors, the conventional methodology, and it was decided to change the details of the methodology regarding the seven items described below.

Key Points

1. Research scope. In the present study, the main research question was "Can intent change the form of water crystals?"

2. Type of judgment was changed from aesthetic to morphological. Previously, photographs of water crystals have been rated by whether they are beautiful or not (Radin et al., 2006, 2008). However, aesthetic sensibility differs among individuals. Therefore, it is desirable to adopt a more objective criterion to evaluate photographs. In the present study, to achieve more objective scoring, the judgment of photographs was based on a morphological factor: "How close is the crystal to the hexagon form?"

3. Simple judgment procedure. Judges were university students of classes taught by H.K. Photographs of all the crystals were placed on four sheets (one for each of the paired bottles in each of two conditions), and the photographs on each sheet were arranged according to the order in which they were taken. A total of 24 sets of judgement sheets were prepared. Each set had a different order of the four sheets (4! = 24 sets). Judges rated all photographs by referring to an instruction sheet. Use of judgement sheets is not the best procedure. However, at least, an order effect of bottles is cancelled systematically because each set of judgement sheets is composed of a different order of sheets (bottles).

4. Experimental task based on the judgments. A healer (S017, female) was instructed to intend that the target water forms hexagonal crystals. Therefore, by examining the extent of hexagonal crystal formation, it was easy to determine whether any anomalous effects were caused by her intent, and also to determine whether the intent facilitated or inhibited the hexagonal crystal formation.

5. Equalization of conditions of crystal formation by use of paired experimental and control samples. The target crystal is formed on the top of a block of ice (Figure 2). The core part of a crystal is formed in the freezing process and it grows horizontally to become hexagonal by vapor deposition in a low-temperature environment. Therefore, in the present study the crystal formation process could have possibly been affected by the internal environment of both the freezer and the low-temperature room. If the crystals had been produced on different days, their forms might have been influenced by slight differences among conditions such as temperature, humidity, atmospheric pressure, and adhesion of the frost in the freezer.

In the previous studies using photography, the days on which the photos were taken were different for experimental and control bottles. However, in the present study, the paired experimental and control bottles of water in the main trial were treated simultaneously on a single day. And on another day, the paired experimental and control bottles of water in the blank trial were also treated simultaneously.

Specifically, 50 sample Petri dishes were prepared from each water-filled bottle of a pair of experimental and control trials of the main or blank test, and then the dishes from the bottles were arranged alternatively in the freezer as shown in Figure 5. In this way, minor variations between experimental and control bottles in the circumstances of crystal formation and photography were cancelled. The maximum number of sample dishes was limited to 100 per trial because of the capacity of the freezer and of the time needed to prepare the sample dishes. In addition, during this process, the operator (Y.N.) had not been given information about which bottle was experimental and which pair of bottles was to be used for the main test (double blind condition).

6. Blank condition. In previous studies, not enough consideration was given to fluctuations in the extent of crystal formation. Therefore, in order to estimate the degree of fluctuation, the authors added a blank condition without a healer. The blank trial was executed in the afternoon one day before the corresponding main trial because anomalous remote effects by the healer are more likely if the main and blank tests are done on the same day (Kokubo & Shimizu, 2015).

7. Complete sample of photographs. In the first study by Radin et al. (2006), only 40 of 200 photos were analyzed. This is because the operator passed to researchers only "good" crystal photographs. In their second study (Radin et al., 2008), the operator passed all photographs to researchers. Similarly, in the present study, the authors analyzed all the photographs of all the crystals.

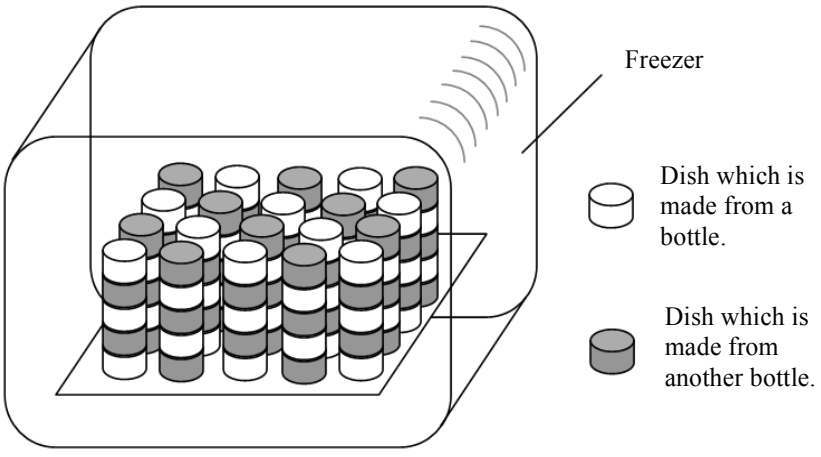


Figure 5. Arrangement of sample dishes in the freezer. All dishes are covered with lids.

Hypothesis

If the healer applies her intent to an experimental water sample with the aim to form hexagon crystals, the extent of hexagonal crystal formation will differ between the experimental and control water samples.

Method

Date and place. This experiment consisted of two sessions, and each session consisted of judgement and a pair of main and blank trials. The first session was done October–November, 2013 and the second session was done March–April, 2014.

At each session, a main trial in which a healer applied her intent to the target water sample was done in the afternoon, while a blank trial was done in the afternoon one day before the day of the main trial at the Institute for Living Body Measurement of the International Research Institute (Chiba, Japan). Preparation of dish samples and photography were done at I.H.M. (Tokyo, Japan) within a few days after the main trial. Photographs of all sample dishes were placed on four sheets (one for each experimental and control bottle in the main and blank conditions), and then the judges gave scores to all the photographs.

Healer. Healer S017 was a 47-year old female who had repeatedly shown large J values ($J > 0.1$) in previous healing studies executed at the International Research Institute (Kokubo, Koyama, Takagi, Kawano, & Yamamoto, 2012; Kokubo et al., 2013a, 2013b; Minami, Usui, & Kokubo, 2014). This study was her first experience in an experiment to form water crystals. Here, J is an index of the magnitude of bio-PK power, and it is defined as a natural logarithm of the ratio of physical measures on experimental and control trials. Physical measures are the intensity of biophotons or gas concentration in the authors' bio-PK experiments. In biophoton experiments, $J = 0.1$ is equal to 0.43 dB. The healer's power can be categorized as: $J < 0.1$, beginner class; $J > 0.1$, middle class; $J > 0.2$, expert class; and $J > 0.3$, psychic class (Kokubo, 2015).

Sample water. The water was purified water (distilled water, 500 mL) initially kept in plastic bottles (Kyoei Pharmaceutical Co., Ltd., Japan; Lot No. 1501).

Double blind. Experimenters were E-1 (H.K.) who did the main and blank trials, coordinated the judging, and analyzed the data; E-2 (K.K., one of the authors) who kept the ID numbers of the sample bottles, and E-3 (Y.N., operator) who prepared the sample dishes for storage in the freezer and took the photographs. After finishing the main trial, E-2 randomly numbered the sample bottles (four bottles: two of them were bottles for a main trial, and others were bottles for a blank trial) and recorded their numbers. E-2 told E-1 only which bottles were paired. Next, E-1 gave this information to E-3 and asked him to prepare the sample Petri dishes, store them in the freezer, and take the photographs.

After the photographs were grouped for each bottle, they were given to E-1. E-1 made 24 sets of sheets of photographs and passed them to the judges. After E-1 made a preliminary analysis of the judgments, E-2 gave the ID numbers to E-1.

The same procedure was repeated at the second session.

Main condition. E-1 chose a pair of bottles at random with a dice, and he used one of them as experimental and the other as control. The healer sat on a chair (Position P in Room A in Figure 6) and tried to generate hexagonal crystals for 30 minutes while holding the water-filled target (experimental) bottle in her hands or setting it on a table. At that time, she used a picture of a hexagonal water crystal on the table as a reference (Figure 7). Room temperature was 23.5–26.5°C and humidity was 22–23%.

The other bottles for this condition were kept at Place C in Room B with the same temperature and humidity.

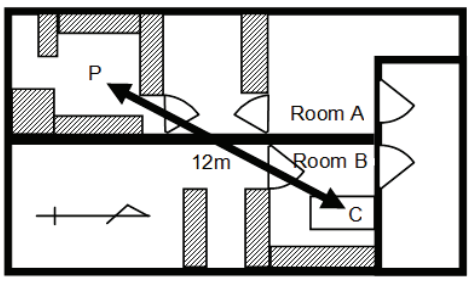
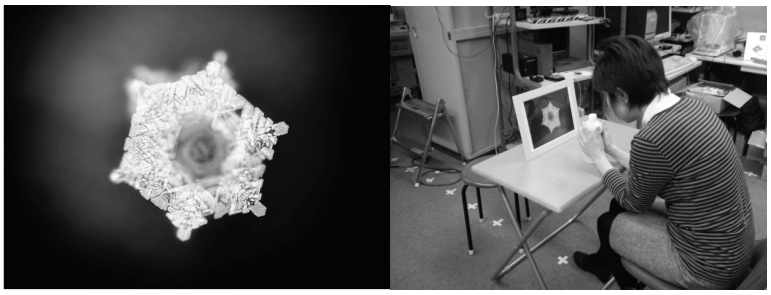


Figure 6. Location of rooms for the experiments. P: Location of target bottle. C: Location of all other bottles. The shaded gray blocks are pieces of furniture.



(a) (b)

Figure 7. (a) A crystal. (b) Main trial with the healer

Blank condition. A blank trial was done one day before each main trial. The blank test procedure was the same as for the main tests except that there was no healer. An experimental bottle was set on a table in Room A for 30 minutes (Figure 8). Room temperature was 25°C and humidity was 26–31%. The other bottles were kept in Room B during the blank tests.

Figure 8. Blank trial without the healer

Randomization. After a main trial, E-2 took the experimental bottle to Room B and then randomly numbered all the bottles for the main and blank conditions. Next, E-1 wrapped all the bottles with packing sheets and put them into a box. E-1 carried the box to E-3 at I.H.M. immediately. E-3 prepared the sample Petri dishes soon after receiving them and stored them in the freezer. At the second session, all bottles of the main and blank trials were treated in the same way.

Growing the crystals and taking their photographs. The water-filled sample bottles (paired experimental and control bottles for the main and blank trials) were given to E-3. He prepared the sample Petri dishes in which water crystals would grow, and he took their photographs the next day. The details of the procedure are the same as described in the section Basic Method, except for equalization of conditions of crystal formation by using paired experimental and control bottles. Photographs were grouped for each sample bottle and then passed to E-1. The same procedure was repeated at the second session.

Judging. E-1 serially numbered the 50 photos of each bottle according to the order in which they were taken. Then he affixed the 50 photos on an A3 size sheet of paper (in total four sheets: two paired experiment/control samples for the main and blank trials), for a total of four bottles per session. These four sheets formed the 24 sets used for judging with the order of the four sheets different for each set.

A reference picture sheet was prepared (Figure 9) for the judges. The judges rated all the crystal photographs according to their conformance to the reference pictures. It took 15–20 min to judge all 200 photos. Judging was done by 20 students for the first session.

At the second session, 200 photos were prepared in the same way as for the first session and judging was done by 18 different students.

None of the students had experience in judging water crystals until this study.

Analysis. The authors counted the numbers of photographs which the majority of judges had classified as A or B. After a preliminary analysis of each session, information on which pair of bottles was for the main trial and which of these bottles was the experimental bottle was given to E-1 and E-3 by E-2.

Results

Distribution of photo ratings. The authors counted the number of photographs which have ratios that were larger than 0.5 and defined the group as A+B photos. Figure 10 shows a distribution of the 400 photos as a function of the proportion of judges who judged a certain photo as A or B. For example, the left-edge bar represents the number of photos (150) which were not rated A or B by any of the judges, and the right-edge bar represents the 30 photos which were rated as A or B by all the judges. As there were 20 judges for the first session but 18 judges for the second session, the X-axis is the proportion of judges who judged a certain photo as A or B.

This distribution can be considered as a distribution of ratings against photos. It is a non-Gaussian distribution having two peaks of numbers of photos at both edges. Many photos were rated as no hexagon.

Descriptive statistics for the A+B photos. Figure 11 shows the number of A+B photos which the majority of judges classified as A or B. Absolute values of the differences between experimental and control bottles in the main trials were larger than absolute values in the blank trials. Especially, in the second main trial, the difference was large. However, the range of ratings of controls in the two main trials (first and second C) and the two blank trials (first and second BE and BC) was large, from a minimum of 4 to a maximum of 17; average was 10.3; *SD* was 5.05 (For all the bottles, the average was 10.8 and *SD* was 4.62). If experimental data of main tests were compared with data for all control and blank bottles, the deviation of the first E was -0.26σ and the deviation of 2nd E was 0.92σ. This suggests that even if human intent can change the formation ratio of "good" crystals, the magnitude of its effect is expected to be equal to or smaller than the magnitude of natural fluctuation.

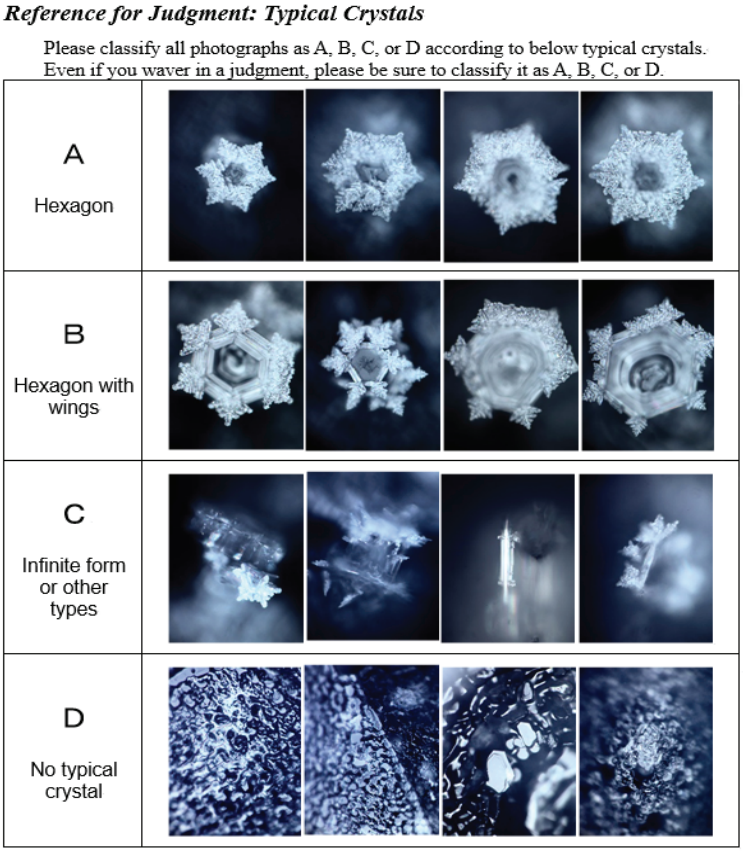


Figure 9. Reference pictures for judging.

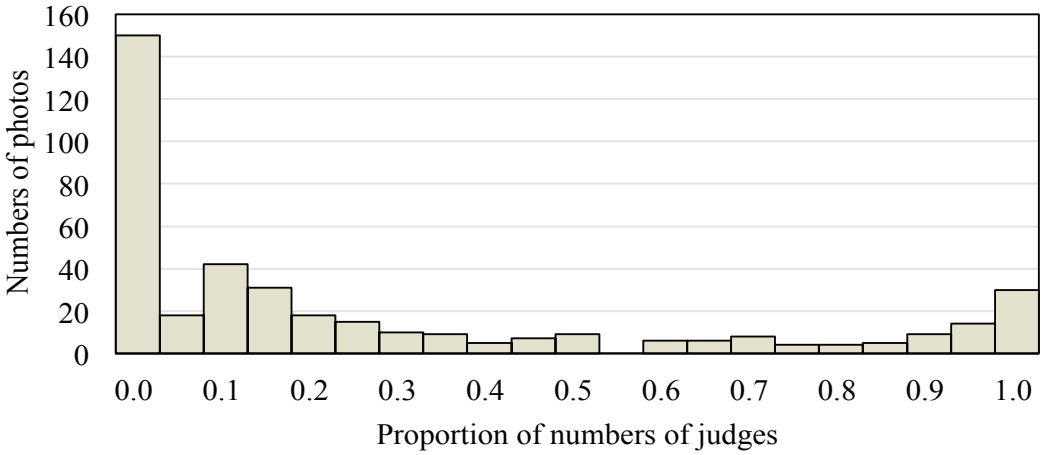


Figure 10. Number of photos rated A or B by a given proportion of judges. The X-axis is a proportion, because the numbers of judges were different for the first and second sessions.

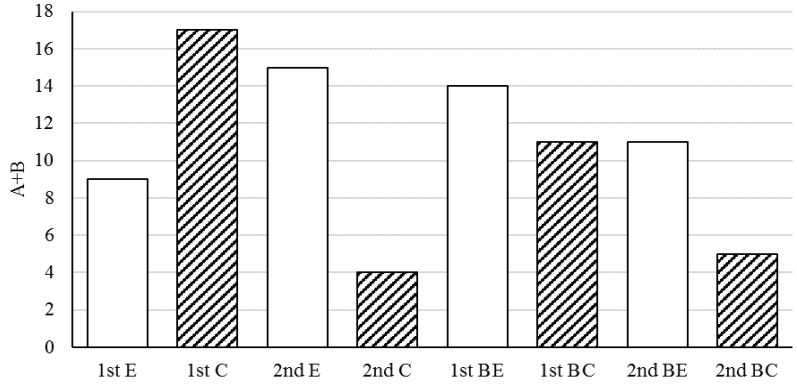


Figure 11. Numbers of A+B photos in the eight conditions. E: Experimental in main test. C: Control in main test. BE: Experimental in blank test. BC: Control in blank test.

Crystal formation as a function of dish position in the pile. Petri dishes were piled atop one another in the freezer. There is a possibility that the formation of water crystals was affected slightly by the position of the dish in the pile, because the lids of the top dishes were exposed directly to the air inside the freezer.

Table 1 shows numbers of photos by position (top and other). The number of A+B photos of top dishes was 11, which is lower than the expected value 17.2. However, the difference of the formation ratio of water crystals was not significant in the present study, $\chi^2(1, N = 400) = 3.55$, $p = .059$, two-tailed.

Table 1
Numbers of A+B Ratings of Dishes at the Top of the Pile Versus Below

position	top	other
A+B	11	75
other	69	245

Although the difference of numbers of photos by position was not significant, the authors consider that the difference may be detected if many sample bottles are used. In fact, the I.H.M. operators claim that

the formation of crystals is often not good in the top dishes based on observation. The reason for this slight difference of numbers of photos by position is still not identified. This is a technical problem in the way of crystals are formed, and it should be improved in the future.

Consistency of judges' ratings. The authors tested the statistical significance of these results by applying the Wilcoxon test to the 20 or 18 pairs of ratings in each trial in Figure 12, and the two-tailed *p*-values at the top of each trial represent the results of these trials. The authors subsequently realized that this test is invalid because, as explained in the Method section, the 20 or 18 pairs of ratings cannot be considered independent. In other words, the proper unit of analysis is not the judge (20 or 18 in each session), but the bottle (2 in each trial). Two bottles are too few to determine the significance of anomalous effects on water crystal formation. However, what is obvious from simply observing the four panels in Figure 10 is that in three of four cases there was high between-judge consistency or reliability of ratings.

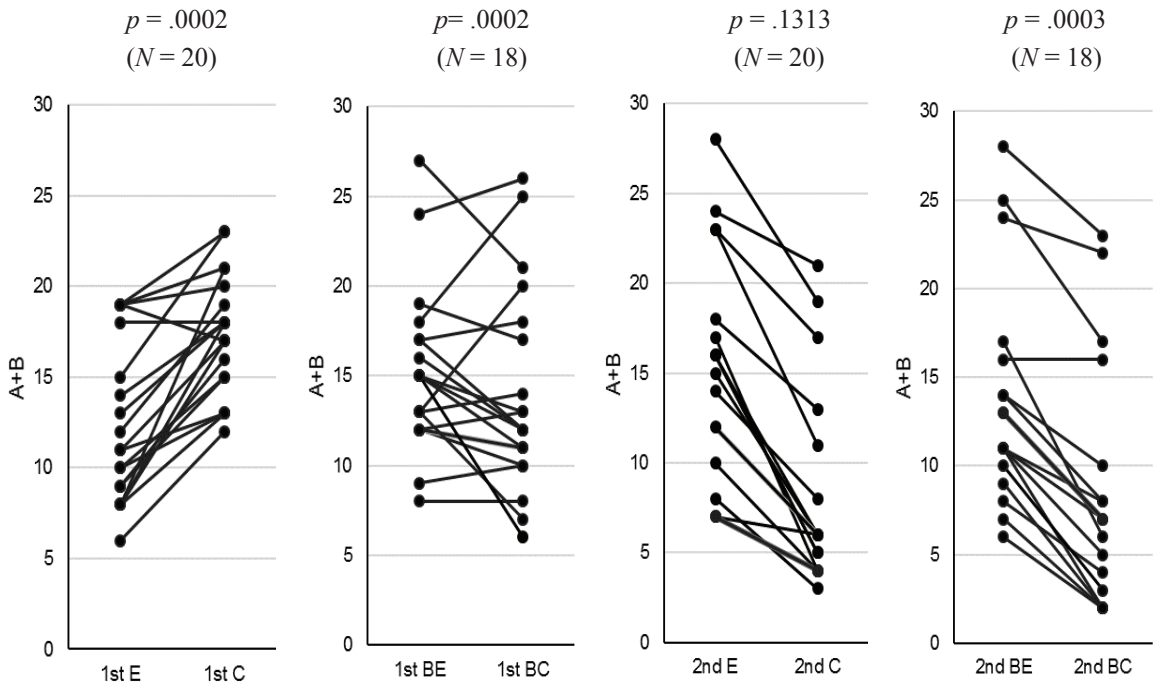


Figure 12. Ratings of the 20 or 18 judges for each pair of experimental and control bottles. E: Experimental in main trial. C: Control in main trial. BE: Experimental in blank trial. BC: Control in blank trial.

Discussion and Conclusion

As shown in Section "Key Points in Method", the authors' tests suggest that researchers (including the authors) had misunderstood the role of judging in conventional tests of water crystal formation, and that two bottles were too few to address anomalous effects. These problems can be relatively easily understood if the researchers recognize them once, or if they try to do the tests the same way that the authors did.

The authors changed the way of making water crystals. Water crystals were made simultaneously for paired experiment and control bottles. In this way, system biases such as temperature, humidity, and the degree of skill in executing the procedure are cancelled, and it is expected that the true effects of human intent can be detected. However, natural fluctuations in the formation ratio of "hexagon" water crystals were greater than expected. In further studies, the existence of natural fluctuation should be taken into account.

The formation ratio of water crystals is considered to be essentially different depending on the experimental conditions. It is difficult to predict the mean chance expectation (MCE) for A+B photos a priori in a given water crystal test. However, the authors consider that this problem can be resolved partially by

use of a standardized index calculated from matched data from experimental and control conditions. For instance, here the authors explain this idea using dB (although they usually use *J*, which is an extension of dB, as an index of the magnitude of anomalous effects in their experiments with cucumber pieces as the bio-sensor; Kokubo, 2015; Takagi et al., 2015). In the present study, the authors used paired experimental and control bottles, and the dishes were placed in a freezer simultaneously (Figure 5). Therefore, the same system biases were applied to the experimental and control dishes. The possible biases are essentially cancelled when paired experimental and control samples are compared. First, the ratio of A+B photos of experimental vs. controls crystals is converted to a dB unit; dB is defined as 10 log(E/C). If there is no special effect and no system bias, the MCE of dB can be expected to equal zero a priori in the blank condition. On the other hand, if human intent causes an anomalous phenomenon, dB will not be zero in the main condition. If main tests are repeated many times, the average of magnitude of the power of the intent can be estimated with confidence intervals. Even if there are some system biases and MCE in the blank condition is different from zero, a true dB can be obtained as a calibrated dB by subtracting the dB from the blank tests from the dB from the main tests (Table 2). Unfortunately, the present sample size (8 bottles) is too small to estimate the magnitude of the power of human intent. However, this analysis method is considered as useful to consider as a way to measure the magnitude of PK power. For example, this method can yield the same values even if the number of photos per bottle is changed from 50 to 100. In further studies, such a standardized index should be considered.

Table 2
dB Analysis of A+B Photos

Pair of bottles	dB	Calibrated dB	*M*	*SD*
1st (blank)	1.047	0		
1st (intent)	-2.762	-3.809	-0.747	4.331
2nd (intent)	5.740	2.316		
2nd (blank)	3.424	0		

Judgements based on a morphological factor can be made easily, even if the judges had not previously rated photos of water crystals. Thus, such a judging strategy is recommended until artificial intelligence (AI) can be applied to the judging process.

Considering the labor involved in an experiment, the present, conventional methods are not necessarily efficient methods. Chauvin (1988) tried to measure the length of the crystal growth of water using capillary tubes. Chauvin's approach differs from the conventional approach in which the form of the water crystal is tested, and the measured parameters are different. However, such an approach should be reconsidered.

The authors do not deny the possibility that crystal formation of water can be affected by intent. However, the sample sizes of previous tests (including the authors' tests) are too small to assess anomalous effects statistically. This possibility should be tested by more experiments, and the magnitude of the natural fluctuation of the system should be estimated with sufficient accuracy in multiple blank tests.

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International Research Institute
40A, Yuuki Bldg., Sonno 1108-2
Inage, Chiba 263-0051, Japan
kokubo@a-iri.org

**Yasuyuki Nemoto*
I.H.M. General Institute
2F, NS Bldg., Higashi-Nihonbashi 2-6-1
Chuo, Tokyo 103-0004, Japan
yasuyuki.nemoto@hado.com

Abstracts in Other Languages

French

NOTE TECHNIQUE

DISCUSSION SUR LA METHODOLOGIE DE LA FORMATION DE CRISTAL D'EAU COMME SYSTEME DE DETECTION DU PSI

RESUME : Il est souvent affirmé que la formation d'un cristal d'eau peut être modifiée par l'intention

humaine bien que peu d'études scientifiques ont mis à l'épreuve cette affirmation. En 2006, plusieurs chercheurs ont publié le premier compte rendu scientifique qui montrait des résultats positifs en faveur de cette affirmation. Récemment, les auteurs ont également étudié cette question. De façon inattendue, ils ont découvert deux faiblesses méthodologiques graves dans la procédure conventionnelle de test de la formation de cristal d'eau. L'une de ces faiblesses est relative à l'utilisation d'un jugement, l'autre à la taille d'échantillon. Ces points ne sont pas faciles à détecter, et les auteurs craignent que d'autres chercheurs puissent tomber dans les mêmes chausses-trapes. Dans cet article, les auteurs discutent ces problèmes méthodologiques des tests conventionnels, et indiquent que les photographies de cristaux d'eau ne sont pas des paramètres indépendants et que le nombre de bouteilles d'eau utilisé est trop faible pour permettre de conclure sur le plan statistique.

German

TECHNISCHE MITTEILUNG

DISKUSSION ZUR METHODOLOGIE DER WASSERKRISTALLBILDUNG ZUM PSI-NACHWEIS

ZUSAMMENFASSUNG: Häufig wird behauptet, die Form eines Wasserkristalls ließe sich absichtlich durch Menschen beeinflussen, obwohl es nur wenige wissenschaftliche Studien gibt, die diese Behauptung überprüft haben. 2006 haben mehrere Forscher die erste wissenschaftliche Arbeit dazu veröffentlicht, die positive Ergebnisse erbrachte. Die Autoren haben sich kürzlich über dieses Thema nochmals Gedanken gemacht. Sie stießen dabei wider Erwarten auf zwei gravierende Schwachstellen beim konventionellen Testverfahren zur Wasserkristallbildung. Einer der Punkte betrifft die Art der Einschätzung, der andere die Größe der Stichprobe. Diese Punkte waren nicht leicht zu erschließen, und die Verfasser befürchten, dass viele Forscher durch diese Punkte in die Irre geführt werden könnten. In der vorliegenden Arbeit diskutieren die Autoren diese methodologischen Probleme der konventionellen Tests und weisen darauf hin, dass die Fotografien der Wasserkristalle nicht unabhängig voneinander sind und dass die Anzahl der verwendeten Wasserflaschen zu gering ist, um statistische Schlussfolgerungen zu ziehen.

Spanish

NOTA TÉCNICA

UNA DISCUSIÓN SOBRE LA METODOLOGÍA DE LA FORMACIÓN DEL CRISTAL DE AGUA COMO SISTEMA DE DETECCIÓN PARA PSI

RESUMEN: Se afirma a menudo que la intención humana puede cambiar la forma de un cristal de agua aunque pocos estudios científicos han puesto a prueba esta afirmación. En 2006, varios investigadores publicaron el primer informe científico que apoyó la hipótesis. Recientemente, los autores de este trabajo también consideraron esta cuestión. Inesperadamente, encontraron dos vulnerabilidades serias en el procedimiento convencional para evaluar la formación de cristal de agua. Uno de los problemas se refiere a la evaluación y el otro al tamaño de la muestra. Estos puntos no son fáciles de detectar y los autores consideran que muchos investigadores pueden dejarse engañar por estos puntos. En este trabajo, los autores discuten estos problemas metodológicos de las pruebas convencionales e indican que las fotografías de los cristales de agua no son parámetros independientes y que se usaron demasiadas pocas botellas de agua para concluir algo estadísticamente.