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A CORRELATION ANALYSIS BETWEEN SOUND AND MAGNETISM FOR WAVY ENVIRONMENT AROUND VDT (WITH ATTACHMENT OF TECNOAO)

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Abstract

In this paper, first, a methodological principle trial for the quantitative evaluation of the correlative and/or cumulative effect on indoor high-technology pollution has been proposed under an absolutely inseparable relationship at the same time and in the same ring. Then, the effectiveness of the proposed method is partly confirmed through some principle experiment between sound (served for utility) and leaked magnetic field (served for risk) especially before and after attachment of tecnoAO.

INTRODUCTION

Recently, due to the spread of the modern technology, (especially with wide use of IT instruments) the closed interior space in the room and car, as if smog, have been filled with miscellaneous waves such as sound waves, electro-magnetic (including light) and so on. This problem seems to be related even to our environment (or information) ethics, too. This is gradually facing to the problem in every relationship of the world composed of our life and cultural environment, which have some inter-independence property with our will.

In this study, we positively take the standing point that the primary property –"Relationism-First" [1] on every existence should be found in principle first and after then, based on it, every type of inter-independence properties should be individually studied as the secondary property. That is, every linear and non-linear type multi-correlation analyses should be considered at the first stage of a study (i.e., for a search of truth). Only after then, by decomposing the compound effect into each

factor according to our study purpose, the measurement and evaluation only for our specific interesting factor should be considered (i.e., a search of effectiveness) individually.
More concretely, for the compound and accumulation effects, at once, as a new principle trial we have proposed some evaluation method of wavy environment in the actual indoor living style, especially by limiting our study to only two different kinds of factors on environmental wave motion. There can be seen many kinds of the relationship between two contrastive factors such as utility and risk, product and control, and so on. Furthermore, by paying our attention to only natural scientific environmental factors except the cultural environmental factors from which we cannot remove some active-subjectivity even in each element, and based on the mutual intermediation among only natural scientific environmental factors as the first step of study, we have applied the proposed theory to investigating the relationship between sound (served for utility) and magnetic field (served for risk) around VDT while making use of a computer especially before and after attachment of tecnoAO.

A HIERARCHICAL EXTENDED CORRELATION ANALYSYS BASED ON GUIDING PRINCIPLES – "RELATIONISM-FIRST"

High-Tech Pollution – Environmental Problems of Wave Motion Type

Even in the wave-motion type environmental problem, nowadays, we can see many actual phenomena (with few theory e.g., [2]) composed of extensive environmental factors in different fields with mutual latent relationship among them. For instance, these examples are given as follows. The nervous system of mankind is so much affected by any field of sound, light and electromagnetic waves in the neighborhood of the specific frequency band from 15 Hz to 20 Hz (because calcium ions are occasionally lost out). This is particularly induced even by the signal modulated into high frequency band with the slow change of its amplitude. Furthermore, the generated order, generated time interval and each of their proper durations between sound and flash of lightning cannot be recognized as it is. There are the biological priority effect between the sense of sight and the sense of hearing that the sense of hearing is reflected by the sense of sight with more strong ability of evoking attention, the promotion effect between different senses, the synergistic effect between sense and stress, participation in VDT syndrome such as general malaise, relevance to circadian rhythm due to the reflection to the pineal body by the exposure of light and electromagnetic fields, the change of brain waves in the case when we have received sound and light at the same time, chromesthesia, the cooperation effect of music and picture and so on. Since now these modern problems and high technology are relationally double-faced sides of the same coin, we can give many other concrete examples.

In fact, owing to the popularization of IT instruments such as cellular phone, cordless phone, personal computer and so on, both in the inside of the room and in the

inside of the car, we are surrounded more and more by electronic instruments and live always under the exposure of artificial electromagnetic radiation as if smog. So, the environmental problems (such as VDT syndrome, electromagnetic wave erethism and so on) in which the reflection of compound effect and accumulation effect induced by mixture of sound, light, electromagnetic wave, heat and so on, must be taken into consideration are arising even if we choose the problems in the only limited field of the wavy physical science as an example [3]. However, as the present situation in every branch of knowledge, it seems that each problem is artificially decomposed owing to our human professional interest first to some parts in fragments belonging to different fields and in the present condition that each part is separately studied. Furthermore, not only in the acoustic environment but also in the electromagnetic environment which are our central subject in this paper, it is usual that almost all are mainly the studies in the frequency domain and few are studies in the time domain. Even in basic studies to solve the problems, it seems that any of quantitative studies related to compound effect and accumulation effect between different environmental factors such as sound, electromagnetic wave and so on in electrified indoor environment cannot be almost found even as a motive and a trial(It is noticeable that the contrastive correlation effect on the auditory nerve from sound field and the brain stem from magnetic field is already peculiarly reported). If we remember in principle the genesis of our existence, it can be said that there are in principle no any phenomena not related to other different environmental factors including the one in the humanities, either lower order or higher order in their mutual relationship.

Extended Correlation Analysis between Two Factors

The proposed method can be easily extended to the correlation analysis for the relationship among arbitrary number of environmental indexes and/or environmental factors not only in the same field but also in different kinds of fields including the humanities. This should be in principle satisfied to cope with actual problems. However, in this paper, by paying our attention to factors in only natural scientific field which are mainly in a passive state and are easy to be proved, the proposed method is limited to the relationship between only two factors x, y as a trial in an early stage of our study. Then, the relational effects caused by the medium of the 3 rd, the 4 th factors, and so on (sometimes functioning as catalyst) and appearing first when many factors gather, are artificially neglected in advance. However, generally, in any problem, main two faces: utility and risk can be always found and they must be considered at the same time and in the same ring. So, the proposed theory seems useful even though it is limited for only two factors.

Now, let us state the summary of the extended correlation analysis[1]. Supposed that stochastic variables x and y are two indexes selected as environmental factors, they usually fluctuate in complicated probability distribution form deviated from any standard probability distribution. To express the complicated probability density function(abbr., pdf) hierarchically, the following orthonormal series expansion form can be generally used:

$$P(x,y) = P_0(x)P_0(y)\sum_{m=0}^{\infty}\sum_{n=0}^{\infty}A_{mn}\varphi_m^{(1)}(x)\varphi_n^{(2)}(y)\,, \tag{1}$$

$$A_{mn} = \left\langle \varphi_m^{(1)}(x)\varphi_n^{(2)}(y) \right\rangle, \tag{2}$$

where $P_0(x)$, $P_0(y)$ are the well-known standard pdf forms by which dominant fluctuations of x, y are described, respectively, and $\varphi_m^{(1)}(x)$, $\varphi_n^{(2)}(y)$ are orthonormal functions with weighting function $P_0(x)$, $P_0(y)$, respectively and $< >$ denotes an expectation operation with respect to x and y.

Every linear and non-linear type correlation information in which the intermediation to y based on the fluctuation of x is reflected can be presented by the conditional pdf, $P(y|x)$, of y conditioned by x. Its general form can be obtained as follows:

$$P\left(y\middle|x\right) = P_0(y)\sum_{m=0}^{\infty}\sum_{n=0}^{\infty}A_{mn}\varphi_m^{(1)}(x)\varphi_n^{(2)}(y)\Bigg/\sum_{m=0}^{\infty}A_{m0}\varphi_m^{(1)}(x)\,. \tag{3}$$

By using Eq. (3) and the following orthonormal series form of y^k :

$$y^k = \sum_{i=0}^{k}C_{ki}\varphi_i^{(2)}(y)\,, \tag{4}$$

the regression function of y^k with respect to x can be concretely expressed by the following hierarchical form:

$$\left\langle y^k \middle| x \right\rangle = \sum_{m=0}^{\infty}\sum_{n=0}^{k}C_{kn}A_{mn}\varphi_m^{(1)}(x)\Bigg/\sum_{m=0}^{\infty}A_{m0}\varphi_m^{(1)}(x)\,. \tag{5}$$

Furthermore, by making use of all of the above used mutual correlations, the whole probability distribution of only one variable can be estimated and/or predicted from the observed data of another variable. That is, the pdf $P_s(y)$ of y from the observed data of x can be estimated and/or predicted by use of the following form:

$$P_s(y) = P_0(y)\sum_{i=0}^{\infty}E_i\varphi_i^{(2)}(y) \tag{6}$$

with

$$E_i = \left\langle \sum_{m=0}^{\infty}A_{mi}\varphi_m^{(1)}(x)\Bigg/\sum_{m=0}^{\infty}A_{m0}\varphi_m^{(1)}(x) \right\rangle_x, \tag{7}$$

where $< >_x$ denotes an expectation operation with respect to x.

Inversely, the similar formula concerning to x from y can be obtained.

MUTUAL CORRELATION ANALYSIS OF EXPERIMENTAL ENVIRONMENT AROUND VDT

When DVD video was played by a digital computer, the sound at the location of 30cm distant from a personal computer and the magnetic field strength at the location of 30cm distant from VDT were measured each 5 seconds and 128 sets of sampled values were obtained. The setup of this experiment is shown in Figure 1. In this experiment, the sound level and the magnetic field strength was measured especially

for two cases when tecnoAO was not attached to VDT and the case when tecnoAO was attached to VDT. The proposed theory has been applied to this data by employing Gaussian distribution as standard distribution $P_0(x)$, $P_0(y)$. The result for the case without attachment of tecnoAO is shown in Figures. 2 to 4.

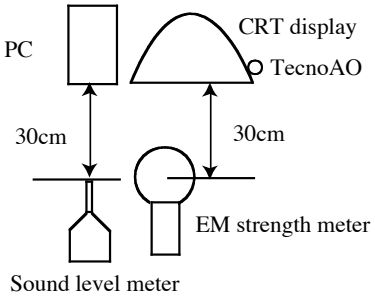

Figure 1 – Experimental setup.

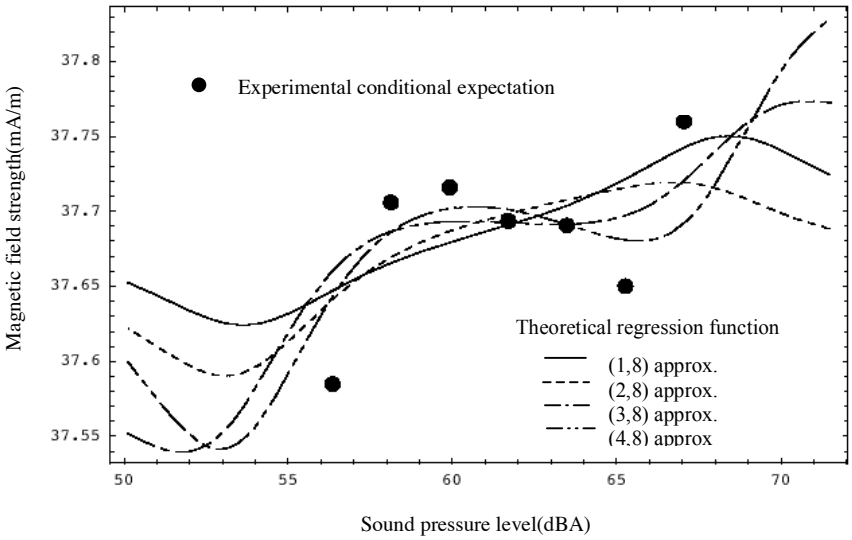

Figure 2 – A comparison between experimental conditional expectations and theoretical regression functions of magnetic field strength to sound without attachment of tecnoAO.

Figure 2 shows a comparison between experimental conditional expectations and the theoretically approximated curves of the regression function of magnetic field strength from sound pressure level. Then, in Eq. (5), as the denominator, initial term and the terms from the 1st to the 8th order were used, and as the numerator, initial term and term of the 1st order, initial term and terms from the 1st order to the 2nd order, initial term and terms from the 1st to the 3rd order and initial term and terms from the 1st to the 4th order were used. We call them (1,8) approximation, (2,8) approximation, (3,8) approximation and (4,8) approximation curves, respectively. From this figure, there can be surely seen equilateral correlation between sound level and magnetic field strength. Each of the figures 3 and 4 shows a comparison between theoretically estimated cumulative probability distribution curves (calculated by use of Eq. (6)) and experimental values. Then, in Eq. (6), initial term, initial term and

terms from the 1st to the 3rd order, and initial term and terms from the 1st to the 6th order were used as the 1st approximation, the 4th approximation and the 7th approximation, respectively.

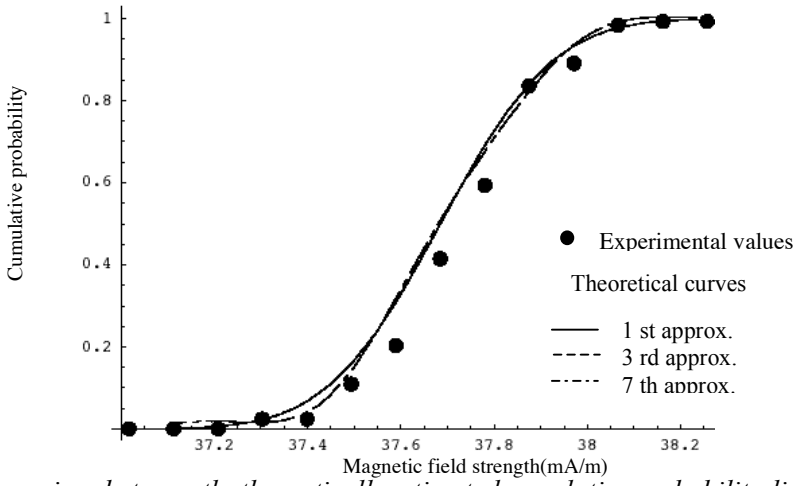

Figure 3 – A comparison between the theoretically estimated cumulative probability distributions of the magnetic field strength based on sound pressure level fluctuation and experimentally sampled values without attachment of tecnoAO.

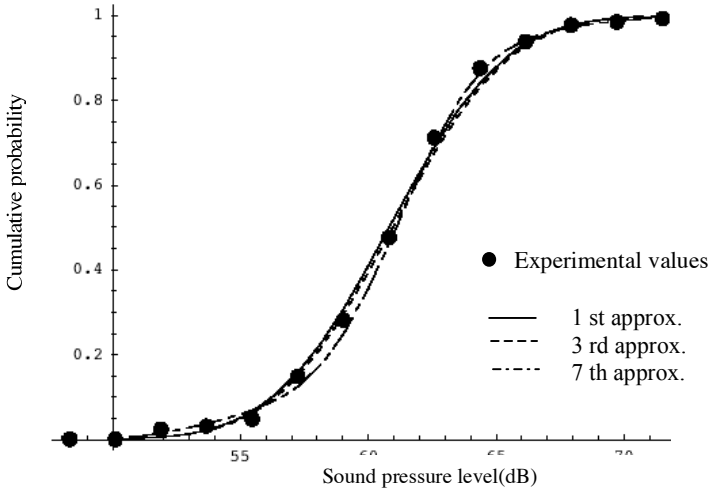

Figure 4 – A comparison between the theoretically estimated cumulative probability distributions of sound pressure level based on the magnetic field strength fluctuation and experimentally sampled values without attachment of tecnoAO.

From these figures, it can be seen that the difference between theoretical curve and experimental values becomes somewhat smaller as the degree of approximation increases.

The result for the case with attachment of tecnoAO is shown in Figures 5 and 6. Figure 5 shows a comparison between experimental conditional expectations and theoretical regression function of magnetic field strength to sound with the attachment of tecnoAO. From this figure, the theoretical curve shows only a little

change even though the degree of approximation increases and the correlation between sound level and magnetic field strength seems to become weaker than the case without tecnoAO. Figure 6 shows a comparison between the theoretically estimated cumulative probability distributions of the magnetic field strength based on sound pressure level fluctuation and experimentally sampled values with the attachment of tecnoAO. From this figure, it can be seen that the theoretical curve agrees better to experimental values as the degree of approximation increases.

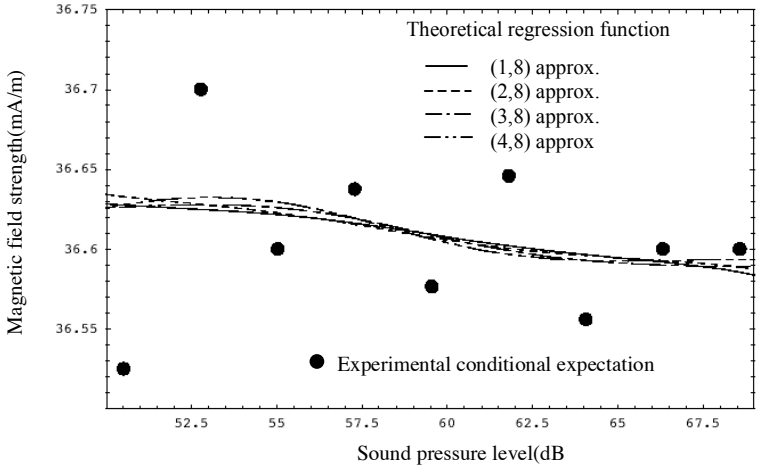

Figure 5 – A comparison between experimental conditional expectations and theoretical regression function of magnetic field strength to sound with attachment of tecnoAO.

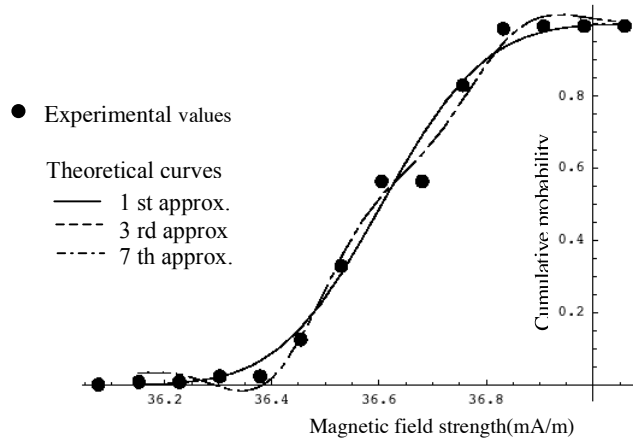

Figure 6 – A comparison between the theoretically estimated cumulative probability distributions of the magnetic field strength based on sound pressure level fluctuation and experimentally sampled values with attachment of tecnoAO.

Furthermore, Figure 7 shows a comparison between the cumulative probability distribution for the case without attachment of tecnoAO and the one for the case with attachment of tecnoAO. From this figure, it can be seen that the fluctuation of magnetic field strength (served for risk) becomes remarkably smaller in the case with attachment of tecnoAO and the mean of the fluctuation of sound level (served for

utility) isn't much affected.

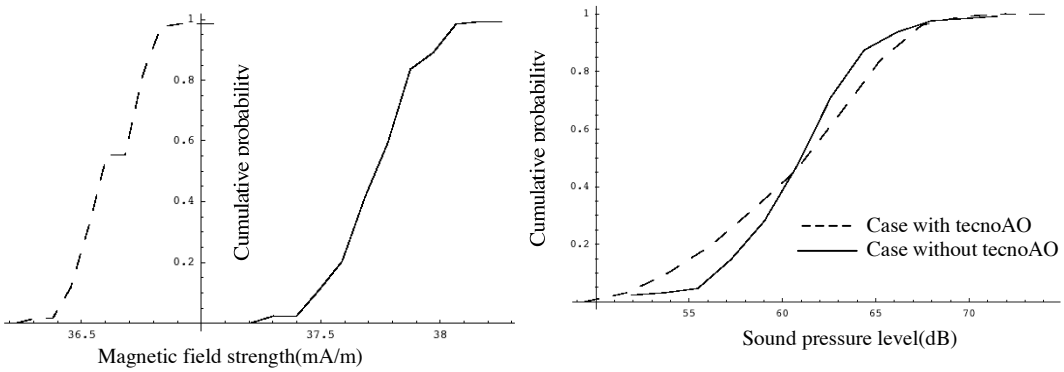

Figure 7- A comparison between cumulative probability distribution for the case without attachment of tecnoAO and the one for the case with attachment of tecnoAO.

CONCLUSIONS

In this paper, from the guiding principle – "Relationism-First" as the key to solve serious problems that confront us in the present time, an extended correlation analysis to the environmental problem such as high-tech pollution, in which two contrastive factors should be considered, has been proposed. Especially, it has been applied to the relationship between sound and magnetism around VDT especially before and after attachment of tecnoAO and its effectiveness has been experimentally confirmed. Furthermore, based on the contrastive experimental result before and after attachment of tecnoAO that the sound fluctuation isn't almost affected, although the magnetic field is remarkably reduced, it may be realized that the magnetic field fluctuation with attachment of tecnoAO can be predicted each other by the medium of the sound fluctuation and furthermore, in spite of real existence of mutual correlation, approximately, the sound can be treated as some standard axis like as time axis on the change of magnetic effect(without standing on the viewpoint: "Relationism-First", it is afraid to mistake in view of only result so that there is no any relationship in this case between sound and magnetic waves).

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