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A Short Introduction to *MedicoMusik*

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Introduction

In this short note, we are going to outline our idea of *MedicoMusik*, which means our integrated view and methodology towards a scientific and evidence-proved investigation of effective music to human health. On this theme, we are now preparing a book that describes the full perspective of *MedicoMusik*, and we strongly recommend interested users to examine our book to be published soon.

What is *MedicoMusik*?

We coined the term *MedicoMusik* to represent *Medico* (from Latin 'medical') and *Musik* (German for 'music'). The rationale behind us choosing *MedicoMusik* is that we wanted to highlight the impact of music on human health and how music is capable of improving the well-being of man [1-7].

MedicoMusik differs greatly from other conventional researches conducted on music therapy. Conventional studies on the topic are comprised of two main fields: one is research done on music itself, and the other is research done on the way people react when they listen to music. On the one hand, research on music itself is made up of two sub-fields: one is engineering, and the other is musicology. On the other hand, research on human reaction can be divided into two sub-fields: one is a subjective psychological analysis, and the other is an objective mathematical analysis of the brain function. We have found that few researchers have tried to practically apply these fields and sub-fields with regard to the illumination of the whole understanding of the influence of music on man. Almost all the researchers have been confined to their own fields or sub-fields and have hesitated to combine their research with other neighbouring fields or sub-fields in order to offer better music therapy. Though we respect each and every research conducted in all fields or sub-fields, we must admit that not a single study carried out in any of the fields or sub-fields could create a feedback loop to provide better music to man.

This particular situation is the reason why we chose the name *MedicoMusik*, which aims to build an integrated system toward the understanding of the human reaction to music. It also contributes to the concept that better music can, indeed, prove to be effective.

MedicoMusik steers toward proving the effectiveness of music, which means to determine people's psychological response when they listen to music. Figure 1 illustrates the concept of *MedicoMusik*. In this figure, we show three characteristics of *MedicoMusik*. The first one is that *MedicoMusik* requires profound and interdisciplinary knowledge in three distinguished research fields: music theory, acoustic engineering, and medicine. The second characteristic is that

MedicoMusik analyzes biological information in two aspects: one is objective data (biological reaction), and the other is subjective data (emotional reaction). The last characteristic is that it utilizes two types of music analysis methods: one is a method of music theory and the other is of acoustic engineering.
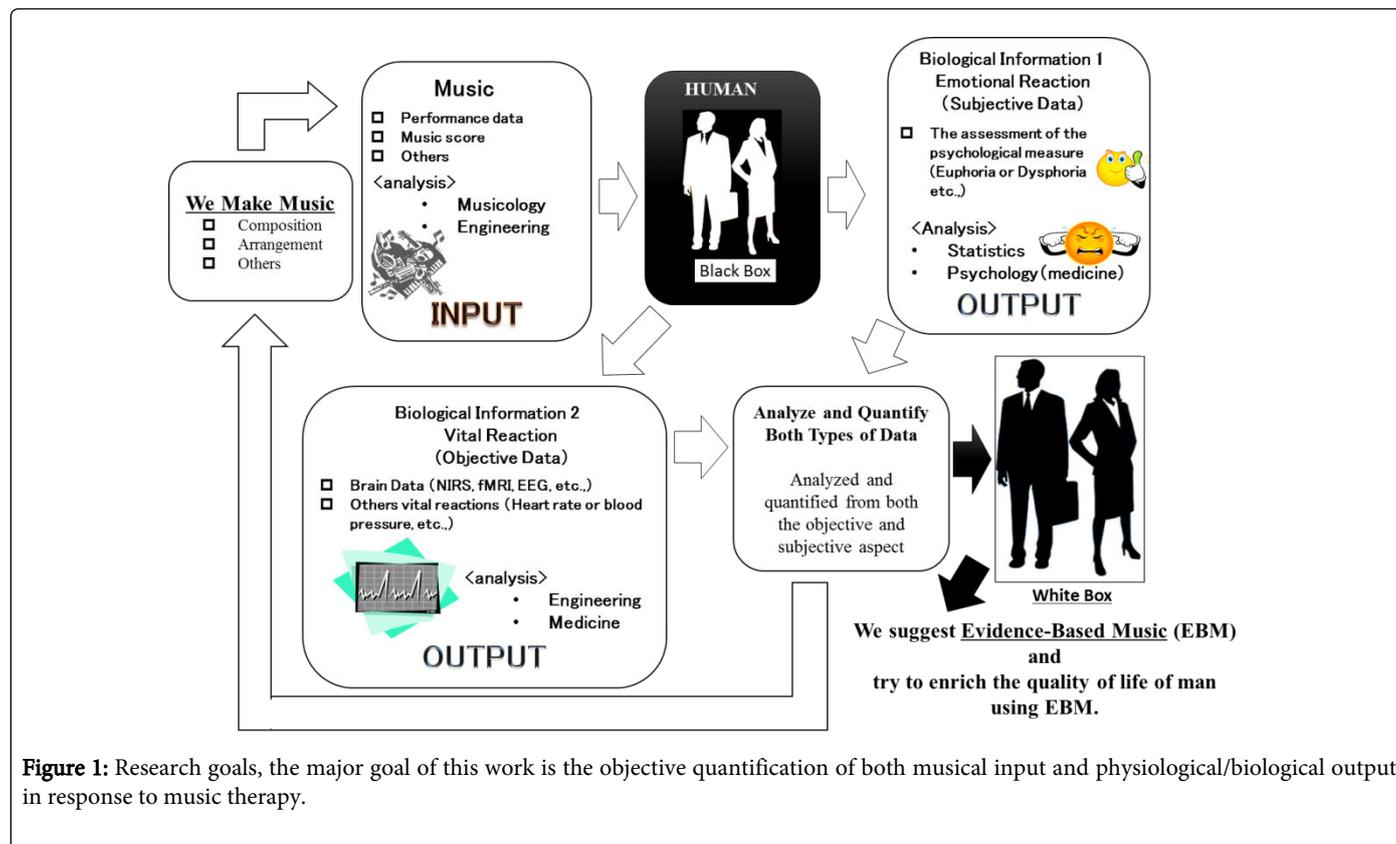
Toward a better understanding of the human reaction to music, at first, we assume that human behaviour is a black box, of whose contents we have absolutely no knowledge about. All we know is the fact that the box has both 'input' and 'output'. Then we analyze human reaction as a function of input onto the output. The input data is music, while the output data is two types of biological information: One is emotional reaction of subjective data, and the other is biological reaction of objective data. First, we analyze the input data of music (performance data, music score, etc.,) using musicology and engineering. Second, the output data of emotional reaction is analyzed with the help of a certain psychological measurement with statistics and psychology, and the output data of biological reaction (brain data, and others) is analyzed via engineering and medicine. Third, both emotional and biological reactions are analyzed and quantified. Fourth, we make music by composition and arrangement based on the quantified data produced in the third phase. Fifth, we use the music made during the fourth stage for the input data. Then we repeat the whole process again from Stage 1 and finally, the black box is no more a black spot but a white and crystal clear area, where everything is obvious and is no more an enigma. This has been achieved by determining the response and reaction of man when he/she listens to music (Figure 1).

MedicoMusik is designed as the integrated and assessed processes illustrated above show. As *MedicoMusik* is scientifically analyzed, it only looks at 'Evidence-Based Music'.

Our background motif under *MedicoMusik*

Here we would like to state our background motif under *MedicoMusik*. Our motif embraces our standing positions in regard to learning including science. We would like to point out learning in ancient times was not divided into detailed subdivisions as it is now in modern days. We would also like to stress the fact that music occupied a far more significant role in the liberal arts of the Classical era than it did in the modern age, which was as important as other sciences such as arithmetic or geometry. We imagine that through this kind of liberal arts education, one must have been able to grasp the essence of music comparatively easier than anyone would be able to now in modern days when learning is divided into many specialties.

To recover the essence of music, we propose a methodology that, at first, investigates music through two counter-facing approaches: one is engineering, and the other is musicology.

Figure 1: Research goals, the major goal of this work is the objective quantification of both musical input and physiological/biological output in response to music therapy.

Then we remodel music through integrated views from the two opposing approaches. At last, we aim to search ways to let music alleviate human health through the views.

We describe our methodology from the first step, respectively. At first, we explain the counter facing aspects of both approaches: engineering and musicology. The principle of engineering is a mathematical analysis of a measured quantity. The mathematical analysis brings objectivity to engineering, which means it makes it independent of observers and analysts. However, engineering itself faces difficulty in finding the core elements of music, which apply taps onto the emotional side of people. Furthermore, the musicians who received authentic music education tend to ignore engineering. By contrast, musicology means a whole lot of 'learnings' and disciplines relating to music, including the history of music, harmonics, musical grammar, as well as musical notation. Musicology is a subjective and complicated web of theories. It is far from being objective and systematic, as it mainly depends on the feelings of both learners and instructors. This perplexing feature of musicology is what makes it a field requiring long and intensive training, which also applies to music specialists. This, in turn, inhibits the understanding of musicology and how it is viewed by the public.

Secondly, we attempt to measure people's reactions when they listen to music. In order to be able to measure the human reaction in a thorough manner, two essential approaches are used: one is a subjective approach, and the other is an objective one. The subjective approach is a method used to measure the human emotional reaction to psychological tests and questionnaires. These tests enable us to rate comfort and discomfort in a direct fashion, even though the tests may lack precision and objectivity. On the other hand, the objective approach assesses the biological reaction when humans react on impulse or emotionally. This method uses scientific apparatuses such as NIRS (Near Infrared Spectroscopy), EEG, and functional MRI. However, these tools fail to show any direct or obvious relation to either the comfort or discomfort of humans.

We believe that the methodology stated above helps to recover the essence of music in the context of learning as a whole. Also, we hope to serve the real welfare and wellbeing of man by providing the best music based on rational reasoning and backed by genuine scientific evidence.

Input in *MedicoMusik*

In our methodology of *MedicoMusik*, the input of the box is set as being 'music'. Then, we try to elucidate the behaviors of the box (human reaction to music). Through this activity, we attempt to approach the recognition of the internal dynamics of this black box (whitening the box) with the application of evidence-based music to humans.

After the input is fixed to music, we denote the input data, which is the music itself. In order to analyze music, we use two types of research areas. One is musicology, a research field for trained music professionals to investigate music in itself. The other is engineering, which quantifies music as vibrations of air and treats and analyzes them as mathematical objects. In order to approach the whole

mechanism inside the black box, it is critically necessary to integrate these two research methodologies (musicology and engineering). However, history shows that these research methods have appeared to be incompatible with each other. The reason for this incompatibility has been partly due to the ignorance of the professionals of one side with the other methodology and the difficulty of learning both skills at the same time.

Though musicology and engineering look incompatible with each other, *MedicoMusik* aims to integrate both areas by compensating for the disadvantages and augmenting the advantages of the two elements using their analysis methods. Also, we assume this research architecture of *MedicoMusik*, which tries to harmonize incompatible-looking analysis methods, is capable of applying to other research fields, as this architecture of research also enables the analysis of other stimuli to humans besides music.

Output in *MedicoMusik*

In *MedicoMusik*, the output data consists of two types of data: One is subjective (emotional reactions of humans), and the other is objective (biological reactions of humans).

We suggest a new integrated analysis method of the output data from both subjective and objective views. We measure the biological reaction (the objective data) with brain activation or non-activation by NIRS, EEG, fMRI, and others. Then, we determine the emotional reaction (the subjective data) based on psychological situations by an evaluation list, a psychological test, a questionnaire, and others. Each type of data has positive characteristics and negative ones. In the biological reaction, the advantage is that this kind of data is sensitive because the subject is unconscious to it and is unable to control this reaction. The disadvantage is that we do not find the meaning of the data because we get the data unconsciously from the subjects. In the emotional reaction, the advantage is that we find the meaning of data to the subjects because we get the data from the conscious subjects directly. On the other side, the disadvantage is that this data is not sensitive because this numerical value depends on the fluctuating psychological status of each subject.

Here we aim at integrating the results of the biological reaction data and the emotional reaction data that have not been incorporated in the conventional research. We secure objectivity and precision with the combined data of both the objective biological reaction and the subjective emotional reaction by means of investigating the correlation of the reactions.

Final Note

In this note, we have described only a brief summary of core notions of *MedicoMusik* due to a limit of length of our manuscript. We are now preparing a book that gives a total and detailed description of our idea of *MedicoMusik* with our latest research results. Interested readers are welcome to read our book and examine the methodology of *MedicoMusik*. We sincerely look forward to and appreciate any scientific critique from our readers

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