concerning sound as a physical vibration and audio signal transmission system of this

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Concerning ‘sound’; it is defined as one among several wave/vibration phenomena dependent on the natural scientific theory. This means physical wave/vibration phenomena where the motion follows the dynamics described by wave-equation formula in physics. As the phenomena assembled under this concept concern the general dynamics described by ‘wave/vibration’ we may find it a bit odd to name all ‘wave/vibration’ phenomena ‘sound’. Because the term ‘sound’ usually refers to wave-phenomena propagating in air, and the term also includes the physiological meaning where the wave phenomena are in an audible frequencies area as the condition on auditory sense. Anyway whether the physical definition or the physiological definition, we are able to regard any definition as a criterion of sound. Still, we could regard the physiological definition as a bit vague compared to the physical definition. Strictly speaking it is difficult to distinguish between a perception of wave/vibration phenomena through the auditory sense or any other sense organs. Also it might be possible to discover that some wave/vibration phenomena, which are not air vibrations, can be heard as sound. In this sense, we could say that the physical definition is the most normalized criterion of demarcation for ‘sound’.

There is a system that translates ‘sound’, as defined above, into other physical phenomena, that are more transportable/conveyable - in order to attempt to reappear in different situations of time and space. We have acquired the technology for this and usually call it ‘audio transmission system’. This system transposes sound and enables a high possibility of reappearance and transportability. According to this transposition the concept of ‘sound’ maintained by physics vanishes. In a way, sound in the process of audio transmission is no sound. Moreover, when it reappears it happens under some limitation. And we may face the problem whether we can call this process reappearance’ or not. Finally we can talk about the specific limitation of the reappearance, seen from the aspect of physical phenomena. In our personal work we reflect this relation between sound as a physical vibration and the special features brought about by the audio transmission system.

Let us regard the process of sound being passed from a microphone to an audio amplifier and finally reappearing through a loudspeaker: the microphone picks up air vibration, exchanges it for an electric signal in order to move the loudspeakers' cone paper. The wave having 3 dimensions when propagating in the air reflects the vibration of just one dimension at a specific location on the diaphragm side of the microphone. One dimension is set to the direction of air-propagation and the other two dimensions are decided by the orthogonal direction. Thus, the sound reflects the diaphragm's vibration, based on the concept that a three dimensional wave can be observed as an one dimensional vibration. Because of this concept of a concentration of dimension, one dimensional vibration on the diaphragm is transformed into a voltage vibration as one dimension. While in the case of propagating air and the vibration of the diaphragm the concept of wave equation in physics can be applied, it cannot be used when vibration becomes an audio signal through electro-magnetic interaction. From the phenomenological point of view, a wave in the air as sound and a voltage vibration as an audio signal derive from quite different concepts. In the reverse course of the above process, the audio signal is output from a loudspeaker into air as a three dimensional wave.

Now, we have to question the issue of 'precision' of the above system. Hypothesizing the process as linear and mainly concerned with the duration of singular as signal transmission, only the efficiency of this transmission will matter. We might define this efficiency as a ratio of the propagation energy into ideal air condition to any energy loss in actual propagation -i.e. diffusion as thermal energy, resistance by viscosity of the medium and so on. In this case, non-linear conditions such as bending, reflection or interference generated by boundary surfaces of different mediums, and the conditions to become non-wave/vibration phenomena such as electric propagation, can not refer to the concept of singular duration. They are wheedled into efficiency in the system of whole transmission.

On the other hand we can conceive the above mentioned process as a non-linear field operation. This process derives from a translation system. In this case, the issue of precision of the reappearing sound is included in the translation itself. It is possible to regard precision as a condition of translation. For instance, one well known condition is the limitation of upper and lower frequency of electric vibrations in an audio system. Actually, this condition is rather a convenient standard meeting physiological demand, than a condition given by the translation. Anyway, precision as a condition of a translation, including the convenient standard, is concerned with physical operation. For instance, the non-linear condition on boundary surface, like an injection mapping of vibrations on the diaphragm side of the microphone from wave/vibration phenomena in the air, is closely concerned with a setting for boundary conditions on wave equation. If it is impossible for the set boundary conditions to maintain the concept of singular duration, we have to search for a setting of boundary conditions by considering material science and comparable physical matters. Moreover, the audio transmission system has to be defined by the system of electro-magnetic operation field rather than the transmission system, so that we have to consider the effect of the electro-magnetic induction on audio transmission in the electric circuit. It is impossible for these factors, we call them 'perturbation-factors' in physics, to be guided by any concept of singular duration concept. We can say the perturbation factors are a basic part of the issue of precision itself. The non-linear disposition -i.e. I'd call it 'differentiality'- for the basic concept emerges from the perturbation factors involving all possible phenomena. There are appropriate individual concepts for finding individual perturbation factors. We can regard the transmission system as being organized upon these concepts. For this reason, to relate with the individual concept becomes to translate, and the condition necessarily related to the individual concept for this translation is transported on a transmission system.

In this sense, the function of an audio transmission system concentrates on delivery of the variation of vibrational phenomena -and the similarity of phenomena- that is possible to be a sound phenomenon. Something which is to decrease the dimension from incidental phenomena and to deliver to other phenomena, is neither specific to the physical phenomena nor is it a concept. It is impossible to discuss this something as having any 'contents' in the sense of a non-limitational prediction. This something is the temporary and expedient preservation of the variation as the condition on translation. In a way, the transmission system, which is 'abstract' toward the transmission of the 'similarity' of phenomena, is constructed as a concrete transportation of conditions which preserve the variation.

In our project, we deal with the audio transmission system as a translation system - separate from sound. We attempt to make clear how to support the variation to deal with the translation system both from the conditions on the transmission system and from the differentiality/similarity concept between the audio signal and wave/vibration phenomena.

I would now like to talk about the individual work of the WrK artists.

Toshiya Tsunoda deals with 'sound' as the condensation and rarefaction vibrations which are translated to countable phenomena on the voltage vibration. For this he uses an audio frequency counter for hi-fi sound checks. Generally we can conceive physical vibration as a periodical displacement of some standard state. Where we can confine the state to one specific matter, we are able to find some certain boundary conditions as the peculiarity of the state (eigen-value of the state). In such instances we can regard the limited vibration in one dimension as a vibration of string or of air in a cylinder, and we can understand that these vibration phenomena certainly depend on the relation between the spatial length of the string/cylinder and the boundary conditions on both ends. When a generated phenomenon becomes a stationary state of vibration, we are able to discuss the peculiarity of this state from the perspective of the necessary boundary conditions. The vibration phenomena supported by the boundary conditions give a concrete form as sine wave motion. In a way, the concept of 'sine wave motion' which is defined by the concrete boundary conditions like the peculiarity of the state, is formed from experience.

On the other hand, we have regarded the concept of the well known periodical function, the sine function, to be a solution of wave equation that is the mathematical development of a trigonometrical function. In consequence, the actual solution of wave equation becomes an infinite series of linear combinations of sine functions.

Considering the above points, the sine motion of physical vibration is impossible to radically measure as an independent frequency. In a way, to connect with the concept of a countable frequency does not belong to pure understanding of the concept of wave/vibration phenomena, but it projects the condition of translation on specific frequencies. This condition is not dependent on the boundary conditions which are the material and concrete conditions for wave/vibration phenomena in physics. The sine motion translated to the countable voltage vibration is supported by the temporarily and expediently set measuring condition that is independent of the material and concrete boundary conditions. To become countable, voltage vibration must be translated to a ranging non-linear rectangle that is independent of wave/vibration phenomena. It is possible to create the rectangular wave form by superposing sine wave on wave/vibration phenomena. Then we can regard these wave/vibration phenomena as supported by the concept of superposition of sine motion in its basic structure. But the derivation of this ranging non-linear rectangle is different from the concept of superposition of sine motion. We have to regard the countable frequency as supported by another concept for measurable motion of the rectangular wave: as just a particle in the basic structure.

In Toshiya Tsunoda's work, the translation condition of the convenient standard on compact disc is a topic as well. The wave form, which in his work is a rectangular signal on the audio frequency counter, is limited for the translation to compact disc. It is impossible to correctly express the rectangular wave form over 5000Hz at 44.1kHz sampling frequency for the CD standard. Moreover the rectangular waves over 10000Hz are very close to sine waves. There are 2 types of his works which are around 3500Hz and 8000Hz, in order to represent this condition of translation for compact disc.

For his artistic work, Hiroyuki Iida uses the central element of the audio transmission system, the amplifier. The amplification of an audio signal is guidelined by the concept of the analogue circuit, which exists to realize the concept of logical operations. In this, the process has to guarantee that each independent operator can function as addition or multiplication for each electric component/element which constructs the circuit in order to realize the amplification. In a way, the process demands to secure the proposition and set of the logical operation for each element. In the case where it is possible for the signal to logically proceed like a digital processor, it may be regarded that the logical proposition and set for elements have been decided. In the case of an analogue circuit, the process has to physically amplify the audio signal as electric current and voltage. Therefore, it is difficult to exactly decide the logical proposition and the set for each element. This logical proposition and set have to be decided not only for each element but also as an operation field on the whole circuit. We also have to conceive perturbation factors on which every element defined by the basic operations, individually forms the electro-magnetic field. In effect the whole operation for amplification has to be constituted in a way that keeps the perturbation factors within a certain range, which barely holds the linearity of the physical dispositions on individual elements. This operation depends on how far the individual materiality of elements extends and how far the applicable range has been limited in individual elements. In the actual analogue circuit, the elements to adjust the perturbation factors are added into the process of operation. The purpose of the audio amplifier goes toward the wheedling of this perturbation problem into the efficiency of the amplification circuit.

Hiroyuki Iida deals with the condition of an audio signal from the radical viewpoint of logical operation inside the amplification circuit. Ordinary audio systems amplify in a linear way within a limited range which is tantamount to the convenient standard of the voltage variation for electric devices. When the voltage surpasses the limit, it will be wheedled into the limitation range. In Iida's work, his operation for amplification is never over the limitation. He sets up the optional level range into the limitation range. No sooner does the signal surpass the optional level than it will become non-linear by the reversal of the amplification. Therefore the signal will never surpass the limitation level. As soon as the electric amplitude passes the optional range, the audio signal multiplies the frequency so that the wave length is divided into two. To change the condition for the audio signal by this non-linear reversed amplification, an aspect of the translation arises from this transformation of the audio transmission.

Jio Shimizu's work deals with a subject concerning a standard level of the state of the medium which is inevitably set up according to the description of wave/vibration phenomena. When we describe the motion of wave/vibration phenomena, the standard level means a specific displacement of the state that a periodical force of restitution has not generated. In a way, the standard level indicates original state in non wave/vibration phenomena. We can say that this view derives form physics demanding that wave/vibration phenomena should be dealt with separately from other physical phenomena. We can regard 'sound' as a periodical variation of pressure propagated in air. In this case, the standard level is equivalent to the original atmospheric pressure at the observation place for the 'sound'. 'Sound' can be described/defined as the amplitude of periodical pressure displacement observed toward the standard level of the original pressure. However there is also a long periodic pressure variation, that we do not call 'sound'. But we understand that the cause of 'sound' reverts to another cause from atmospheric pressure, and we deal with 'sound' as a phenomenon, separable from the atmospheric pressure. This means that we have to propose a certain reparability in order to be able to regard a phenomenon as an object. In this sense, the standard level of physical wave/vibration phenomena is closely concerned with the conditions of existence for those phenomena.

On the other hand, it is possible to set up at random a standard level of an audio signal formed by an electrical process as translation. In the audio transmission system, the signal transports the standard level by adding a certain gain voltage. When the gain value becomes the standard level, it is possible to describe the electric vibration. When the audio signal is played back, the level is changed to the ±0mV. The cone paper of the loudspeaker is driven by the variation of the electrical amplitude across the positive and negative pole.

Jio's work deals with a standard level of vibrational phenomena which are emitted from a loudspeaker. He uses a recording of a dish rolling on a table as an audio signal. This material is further modified using an electric device. When the audio signal is translated to a physical vibration, the air vibration which is a variation of condensation and rarefaction, standardizes the atmospheric pressure at a standing loudspeaker. His work is based on one function: it is to generate a pulse signal when the audio signal gets across the standard level - in a way, the vibration of condensation and rarefaction on the playing signal coincides with the value of atmospheric pressure at a standing loudspeaker. When the signal vibrates at 1Hz, it gets across the level twice in one second so that the system generates the pulse twice. When, in turn, the state of the audio signal remains at the standard level as 0mV, the system continuously generates the pulse - i.e. Direct Current- so that it does not form an audible signal.

To demonstrate this Jio uses a specific recording-technique in the stereo-system. One channel records the electrically modified audio signal of the changing motion of the rolling dish. The other channel records the pulse signal generated by his system using the above audio signal. Thus he describes a condition of standard level which is closely concerned with the existence condition of physical wave/vibration phenomena.

Finally, I propose in my work, to present a model for transportability of variation as translation. In this model, the variation as an audio signal is conveyed with various phenomena that are to become a vibration of electrical voltage, a shift of temperature and a shift of illumination intensity. When we regard an audio transmission system as a translation system, we have to consider the conveyed conditions. The audio signals in audio transmission systems are quite different phenomena from physical sounding phenomena (as already mentioned in this text). When we take notice of this, one question arises: 'What is it possible to transport in the system?'. I think this simple question points to a most difficult topic. Someone might answer 'information'. But when we attempt to consider information logic, we can consider the semantic aspects following. They are 1) the aspect of meaning of the original phenomenon as source of 'information', 2) the aspect of measurement of the phenomenon as 'information', 3) the aspect of 'reception' as base for 'information'. In these semantic aspects, information logic can only deal with the aspect of measurement. Even, the logic cannot deal with all the aspects of semantics. Unfortunately, we still do not have complete logic, so we cannot transport all the semantics. But the information logic can still be quite useful. It states that it is possible to translate the measurable physical quantities all as 'information'. The audio transmission system has certainly developed because of the achievements based on information logic. Therefore, something which is transportable in the audio transmission system can be regarded as the measured variation of amplitude. Furthermore it is possible to transport the 'informationized' physical quantities by numerous or infinite ways in a transmission system. On the other hand, the transmission system is always limited and fixed to one 'expediential' standard because we demand the signal's reappearance. A transmission system for information has to be fixed physically and systematically. This means that non-separable relations exist between 'information' and the transmission system. In this sense, 'information', depends on the transmission system and it is only possible to make sense of it by the determination of its system. In a way, it is tautological to talk about transporting 'information' in the audio system.

I advocate translating conditions as the measured variation of amplitude of physical vibration in order to avoid the problem of the tautology. From a physics point of view, it is necessary to set up an obvious boundary to separate measurable variation from various perturbation factors, this necessitates various conditions. It is possible to separate these conditions by reverting to individual concepts of the phenomena. For instance, in the case of wave/vibration phenomena, other phenomena become various perturbation factors and this is reflected in the boundary condition of wave equation. Also in the case of an electric circuit, the whole operation reverts to a logic where it is possible to trace back the causality of operations of an individual element, rather than the electro-magnetic field logic. Thus the conditions of a signal in the circuit become separable and translatable. In a way, when the conditions are obvious, it is possible to translate anything that satisfies the conditions.

In my work, I translate the variation as a condition using some phenomena. It is logically possible using these phenomena to set up the boundary conditions in order to separate the variation from various perturbation factors. This translation relates to similarity that delivers the variation of the phenomena. And in this case, it is not necessary to examine the precision of delivery. In my work, the variation as a condition becomes a vibration of electrical voltage, a shift of temperature and a shift of illumination intensity. This is a model to transport the condition on various phenomena and on the individual concepts of them. My work presents similarity of phenomena based on the conditions in translation, and also presents how to acquire high transportability from these conditions.