A Tentative Assumption of Electroacoustic Music as an Enjoyable Music for Diverse People

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Abstract. Music went through a huge transformation between the end of the 19th century and the beginning of the 20th. Part of this transformation involved the separation of music intended for entertainment, which everyone can enjoy, and music that is primarily artistic and philosophical. The latter became more esoteric: today this type of 'artistic' music is often called 'contemporary music', and it has yet to win many supporters. The reason for this is believed to be that the artistic expression of music is 'difficult' for many people to interpret. However, we disprove this theory, developing a workshop aimed at creating electroacoustic, or contemporary, music with a diverse group of people. From these workshops, we determine that electroacoustic music is actually experienced as 'enjoyable' by many people. This paper describes our tentative assumption that both our artistic and research activities support this idea, and its implications to integrating aesthetic and philosophical points of view.

Keywords: Aesthetics · Funology · Avant-Garde music expression
Electroacoustic music

1 Introduction

'Contemporary' music developed between the end of the 19th century and beginning of the 20th. While *contemporary music* literally refers to any current music, today the term has come to mean music of a style that greatly deviates from 'conventional' music, which has a clear tonality and rhythm. This type of music has long seemed esoteric, and there are many who feel listening to this music is painful. Indeed, several musicians have supported this popular views, including Adorno, who refused to appreciate commercial popular music, insisting instead on creating purely artistic music [1], and Boulez, who understood contemporary musicology as the fusion between science and mathematics [2]. These and similar ideologies may be part of why contemporary music does not have as many listeners as other musical entertainment. However it remains unclear whether contemporary music is truly esoteric or unpleasant to listen to in and of itself.

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Over the course of this study, we separately implemented artistic workshops and research into the emotions music evokes. Each activity supports the same answer to the above question: people can enjoy listening to contemporary music. In this paper, we try to integrate both individual initiatives to show how they support our findings.

1.1 Workshop

Over the past 10 years, one of the authors have carried out numerous workshops focused on creating concrete music (*musique concréte*), which is a music composed of various recorded sounds rather than musical tones, with participants who have little to no expertise in musical composition [3, 4]. Most participants are people who have never even listened to this type of music. Pierre Schaeffer, a French sound engineer and composer, developed concrete music in 1948. Along with electronic music, which started in Germany at about the same time, concrete music is one of the major foundations of experimental computer music, or electroacoustic music.

These workshops asked participants to compose their own concrete music using a computer. Most participants were able to compose a piece while enjoying their final product. Therefore, we determined that concrete music, although considered to be difficult to understand, is actually enjoyable for most people.

Therefore, these workshops allowed us to reconsider common assumptions about modern music and ask the following questions:

(A) Is concrete music truly 'esoteric'?
(B) Why have so many people assumed this type of music to be difficult to understand and enjoy?
(C) It is easier for people to create 'esoteric' music than appreciate the modern music made by others?

To answer these questions, we had to understand the meanings and significance of 'esoteric', or electroacoustic, music in these workshops.

1.2 Research on Emotions Evoked by Music

We also attempt to design music generation systems that can adjust the complexity of a piece's musical structure by controlling the cognitive bias adaptive reasoning model [5] and the occurrence of sounds using the amount of information entropy [6]. These systems are based on Meyer's work, who defined music as a human emotion, or a series of anticipations about what comes next [7]. Narmour [8] and Huron [9] inherited his viewpoint, but there is as of yet no musical generation system that quantitatively addresses human expectation. Our two models, therefore, were designed to generate traditional music based on quantitative data of human expectation. However, these models show a tendency for some people to feel 'interested' secondary to a situation's extremely high complexity. Our original research question did not allow us to generate an un-supervised model. However, our finding that people found this music 'interesting' allowed us to link this research with the workshop described in Sect. 1.1.

1.3 Moving Toward Integration

Through workshop and music emotion research, we were convinced that people can enjoy music with high complexity. In this paper, we suggest that concrete music is more complicated than conventional music, but that contemporary music, which is generally regarded as esoteric, can actually be enjoyed by anyone. These results are corroborated by our music generation system, despite this not being its primary purpose. We propose the possibility of integrating concrete music into the field of computer-generated music (i.e. Funology [10]), with the academic validities and viewpoints contained within this field to expand the idea of human ‘fun’.

2 Workshop Methods

In 2011, one of the authors started carrying out concrete music workshops in art museums throughout Japan. The workshops are based on the syllabus for a concrete music composition class taught through the correspondence education department of Osaka University of the Arts, where one of the writers has been a lecturer since 2005. The students there have little prior knowledge of contemporary music and information technology, meaning that the class discussion went beyond computer-generated music to include the wider experience of concrete music. Through these, we found that although concrete music is often lumped with contemporary music and is also said to be too esoteric for the general public, people enjoy the experience of listening to and creating concrete music. This finding inspired us to introduce new educational approaches encouraging more people to experience the production of concrete music. The goal of our workshops, therefore, is to position the creation of a “work space” as relational and project art, in line with the perspective developed within the field of fine art in recent years [11]. Through this approach, we believe that we can develop activities to expand the field of concrete music, which was founded in 1948. The process of carrying out our workshops convinced us that ‘concrete music is joyful music.’

These workshops were generally held from 1–5 p.m. on a weekend. People of all ages, from elementary school students to adults, participated and produced music together using computers. Most workshops were structured as follows:

(A) Participants listen to sample audio materials (Schaeffere, Russolo, Merzbow, Henry, etc.).
(B) Participants record the sound of items they brought from home.
(C) Recorded sounds are transferred to one laptop computer.
(D) Participants make a montage using editing software (i.e. Audacity).
(E) While composing their compilation, participants were urged to describe their composition using words. For example, high/low, hard/soft, movement/no movement, and light/dull, etc.
(F) Participants create a 10–20 s monophonic soundtrack.
(G) Facilitators collect tracks from each participant and play separately, making comments as they go.
(H) Finally, all participants’ tracks are played at the same time.

When recording sounds, participants are encouraged to listen to the sounds originating from each item they brought, rather than trying to put on a musical performance with said item. When creating the montages, participants are instructed to think of some metaphor of imaginative vision that is evoked by the sound, as described in Step (E).

3 Scientifically and Academically Relevant Workshops

During the musical workshops, one of the authors was struck by how many participants laughed together while creating music from everyone's individual work. We suggest, therefore, that the creation of artistic music creates an affinity that is not felt when merely appreciating such music. In light of this hypothesis, we offer a reanalysis of some of our previous studies.

3.1 Activity 1: Measuring the Effects of the Workshop

It was interesting to note that participants uniformly enjoy the final Step (H), when all tracks are played together, despite the fact that individual participants do not necessarily recognize that their work is being played with that of the other participants. In other words, the participants enjoyed listening to the music, even though the final piece has a much greater complexity than when listening to each person's individual recording.

In our 2011 workshop, we conducted a questionnaire survey to evaluate people's impressions of the following music: 'Risveglio di una città', by futurist composer Luigi Russolo; 'Etude aux chemins de fer', by Pierre Schaeffer, the founder of concrete music; and computer-generated noise music by Merzbow (Masami Akita). This questionnaire asked participants to listen to the same audio clips and answer the same questions before and after the workshop. We observed that participants' impressions improved after completing the workshop. This shows that the creation of concrete music enables people to enjoy music that deviated from 'traditional' definitions of music. However, this survey has some limitations: our use of the same listening material for both the before and after questionnaires cannot eliminate the possibility that evaluations improved simply because people became accustomed to the sound. Therefore, there is room for improvement in this survey.

3.2 Activity 2: Electroacoustic Listening Experiment

In 2011, we conducted an experiment to determine whether functions like the elapsed syntax of concrete music existed. This was intended to verify our hypothesis that the progressive continuity of acoustic materials is a consequence, even though the listener is creating inevitability. To accomplish this, we divided a historically distinguished concrete music piece into 33 parts and produced three sound tracks that arranged these sound fragments randomly. We asked 100 different subjects to compare these tracks, including the original piece, however, subjects were not informed which was the original. Nor were most subjects knowledgeable of concrete music.

The results showed that most subjects could not differentiate between the tracks, even though the sounds were in a different order. Even if the chronological sequential order of the electroacoustic music is replaced by a random order, there is no change in listeners' impressions.

In order to make this experiment more precise, we incorporated Schaeffer's understanding of the categorization of acoustic sound materials [12] and the perception of multimodal sound with more modern cognitive science ideas. For instance, Gaver points out that listening to sounds based on affordance theory will complementarily affect both perception and interpretation, rather than physical analysis, which is based on acoustics [13]. This process of clarifying the image of sounds in concrete music, based on an ecological listening experience, is highly compatible with the metaphorical exterior cognitive model proposed by Lakoff [14, 15]. These ideas are a useful strategy for updating Schaeffer's theory about Helmholtz-based acoustics and the relationship between Saussure-based linguistics and the structure of concrete music. However, while we assumed in our analysis that the listener sees no clear causal relationship in the chronological order of the acoustic materials, it is possible that these listeners are somewhat musical themselves, as in our proposed hypothesis. These findings are important clues to the design of the generation model of electroacoustic music. It is important to consider that when people listen to electroacoustic music, they may be 'watching' the photographic scene of each acoustic material being played rather than listening to the sequence of acoustic sounds. Regardless, our findings in this experiment provide major insight into the generative model of electroacoustic music. If we interpret the results of this experiment as if the arrangement of acoustic material in electroacoustic music is coincidental and inevitably undifferentiated, the affinity with our concept oriented in the middle region between consciousness and unconsciousness, shown in Sect. 4, increases.

3.3 Activity 3: Music and Emotion (Symmetric Cognitive Bias)

In 2010, we started designing a music generation model based on human expectation. This research is based on Meyer's theory that music is the continued anticipation for the next musical event [7]. His proposal was subsequently utilized by Narmour in his IR (implication-realization) theory [8] and Huron in his ITPRA (imagination, tension, prediction, reaction, and appraisal) theory [9]. However, neither of these theories develop a music generation model based on quantitative data.

For the purposes of creating such a model, we focus on cognitive bias, an illogical inference model peculiar to humans. Cognitive bias is human-specific non-logical reasoning about the causal relationship of an event. This non-logical reasoning is regarded as the foundation of human intuition. There are several types of cognitive bias, including representative heuristics, but we applied a mathematical model that treats human reasoning based on a symmetric cognitive bias as the probability of an event occurring.

For cognitive bias in causal relationships, $p \Rightarrow q$, where only human beings have inverse reasoning such as $q \Rightarrow p$, the inference behind $\neg p \Rightarrow \neg q$, etc. The former is symmetric bias, the latter is called mutually exclusive bias. We treat the concatenation of existing music from the preceding sound to the following sound as the minimum unit of expectation of music, based on the transition probability, 'loosely symmetric model' (LS), already used in fields to which machine learning has been applied [16]. This system can generate new pitch elements by applying the condition probability, the LS model, and the 'rigidly symmetric model' (RS) to the transition probability of the preceding sound of the existing music and the transition probability of the following sound. As a result of comparing the generated pitch elements, we found that a loosely symmetric model close to the human thought model generates the pitch element most in line with the human sense.

However, there are problems with this system. It can only cope with machine learning by its supervisor and it was difficult to properly incorporate rhythm. In other words, this system can only generate a tonal pitch set that composes a melody based on Western classical music theory as a variant of the original.

We are now paying attention to experience while trying to create an impression evaluation experiment using this system. This experience includes a composer and cooperative researcher, who both laughed when a pitch structure randomly generated by the RS model has a strong symmetry of reasoning. This implies that elements of the music were 'funny' or 'interesting'. However, we cannot determine the exact meaning of the laughter. The RS model has far more states that can be derived as a result than the LS model; it also is better at inference and divergent reasoning.

3.4 Activity 4: Music and Its Complexity

Based on the above music generation system using symmetry cognitive bias, we considered how to realize generation in the unsupervised model. Therefore, we designed a new model treating the accuracy of an event's occurrence by controlling the information entropy mentioned above [6, 17]. In this model, it was possible to variably adjust both the rhythm and pitch between the normal distribution and the uniform distribution from the centre value to the periphery.

First, one period is divided into 32, and each of these are divided into six levels (Fig. 1). By variably controlling the occurrence probability of sound at each timing from the normal distribution to the uniform distribution range, it is possible to control the complexity of the rhythm (Fig. 2). Pitch element is also generated by this method: pitch element can generate the perfect fifth zone in the key circle by 12 tones on the left and right from the central axis as one set. When this distribution approaches a uniform distribution, the probability that the musical intervals of the 12 sounds appear in the octave becomes equivalent, and when approaching the normal distribution, the probability that only the central sound appears in a certain adjustment becomes high.

What is important about this model is the inverted U-shaped function of the Berlyne [18]. This shows the correlation between music complexity and listener satisfaction (Fig. 3). It suggests that a certain complexity is necessary for listeners to appreciate music; listeners feel pleasure when the complexity of a piece is very high or low.

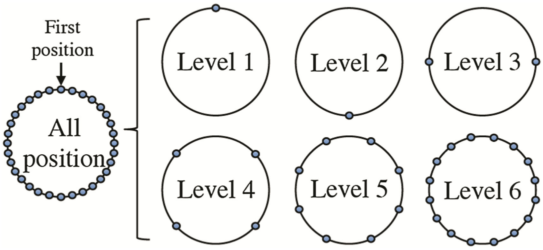

Fig. 1. Six levels of timings of sounds.

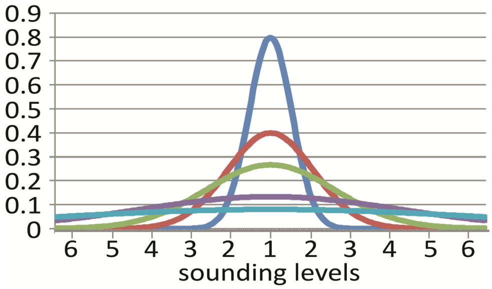

Fig. 2. Probability distributions for sounding points.

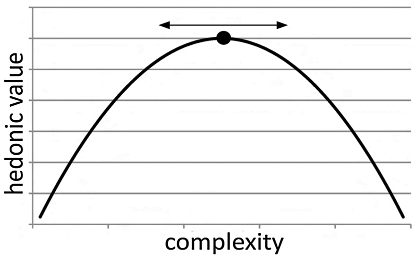

Fig. 3. Inverted U function, originally proposed by Berlyne in 1971

The features of the system we designed include the following three points: (a) it can generate music without a supervisor, (b) the vertex of the inverted U-function of the bar line can be shifted left and right, and (c) since music can be generated at various complexities, this system can also introduce the generation of electroacoustic music composed of more complex sound materials than musical tones. Currently, based on (c), we are attempting to generate concrete music from pieces of recorded sound material. This system can generate not only the timing of sound, but also the sequence of sound materials based on their complexity and control of their contrast.

Although the degree of complexity is a computational concept, we map this concept to an acoustic image we can understand, as mentioned in Sect. 2. The image in which the acoustic material is being forged serves as the label of the image using Lakoff's language metaphor theory [14, 15] and the 'movement' of concrete music is drawn as the shade of the contrast.

It is believed useful to design sequence order with the argument as a label. This system has a wide range of complications, from music based on traditional music theory with clear pitches to electroacoustic music formed from acoustic material without distinct pitch elements, like electroacoustic music. This enables us to create a complexity oriented music structure. In this process of system design, we our focused attention on the possibility that the vertices of the inverted U-shaped function of this bar line have widths on the left and right depending on the era and individual tastes.

4 Strategies Toward Funology

Our concrete music workshop can enhance participants' orientation towards highly complex music. Meanwhile, our music generation system uses symmetric cognitive bias and information entropy to handle variable complexities. At first glance, it seems as if there is no relationship between these two studies. However, in this section, we clarify connection, linking the findings of both studies to research on complexity and consciousness.

4.1 Activity Example 4 – Music and Its Complexity

One of the authors of this study first listened to a piano piece by Schönberg using early 12-tone theory when he was 15 years old. The piece seems to be a collection of sounds that cannot be experienced in any order, and the author's first reaction was, 'This is really music?' This was not a negative reaction, but playful and with laughter. It is necessary to examine whether this laughter derived from awkwardness or, as Bergson suggests, due to 'inserting an irrational idea into an idiomatic phrase' [19]. From this perspective, human kind may have acquired through evolution a type of creativity that utilizes deviations regarded as irrational.

On the other hand, however, as mentioned in Sect. 2, many participants in our workshops felt 'uncomfortable' when listening to the materials presented (i.e. pieces by Russolo, Schaeffer, Merzbow, and Henri). While discomfort does not immediately seem like a situation in which laughter is appropriate, participants gradually found joy in the process of recording sounds from the non-musical items they brought and in the composition of concrete music from these acoustic materials. At this point, participants started to laugh at the abstract musical 'movement' born from their individual compositions. The participants of this workshop, those who were able to enjoy the final composition and appreciate the esoteric music, clearly believe that this vertex shifted to the right. In addition, it may be conceivable that the vertex of Berlyne's inverted U-function shifts based on individual and cultural differences.

It is reasonable to think that the vertex of pleasure (hedonics) shifts throughout history as well. For example, any historical music was, at one point, the 'newest' music of its era. For example, J. S. Bach's complex musical piece dedicated to Friedrich the Great; J. G. Müthel's compositions, in which all the undulations of human emotions are notated in the scores; and Beethoven's work, including the appearance of a full chorus in the final movement of the Ninth Symphony. While there is no way to ascertain whether the music was popular when it was first composed or merely gained popularity as time went on, by the beginning of the 20th century, it was certainly true that any music labelled 'contemporary' would face the utmost rejection from listeners.

Has the complexity of music changed over time? It is true that Western music became more complicated in the shift from the Romantic to Modern period. There was a transition from using three chords (C or Dm) to four (CM7 or Dm7), an increased frequency of key changes, and a trend towards collapsing tonality (and the appearance of atonality). All these suggest that complexity has increased as a combination of frequency ratios. Nattiez positions the rise of noise music and electroacoustic music as the extension of these trends [20].

On the other hand, if we observe the contrast between the end of polyphonic music and the rise of monophonic music, or the appearance of minimal music against the total serialism technique, we cannot assume that music today has continued to become more complex over time. From a relative point of view, we can see that popular musicality tends to go back-and-forth between two poles of complication and simplification. Today we human beings are in a period that values complexity. Since the beginning of the modern era, Western music, including amusement music, philosophical and esoteric music, and world music has been recorded and circulated. In no time, until now, has traditional music of the past been replayed so often. The diversification of musical expression after modernization expanded the left and right width at the vertex of the inverse U-shaped function and accelerated its fluidity. This process can be regarded as an extension of the object people associate with the word *music* (Fig. 4).

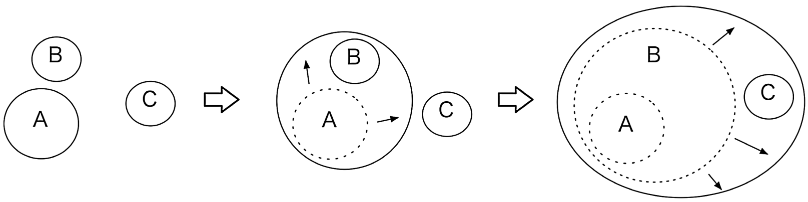

Fig. 4. *kansei*'s process of expansion. The left end refers to a state where only A can be regarded as 'music'. The centre refers to a state in which both A and B are regarded as 'music' as a result of people's mind-sets expanding. As creative attitudes increase, they progress toward the right end of the figure, where A, B, and C, universal realms of the human mind, are all considered 'music'.

We believe that understanding the complexity of musical structures and human pleasure as complementary results in additional possibilities for music generation and increased potential for musical expression and education. In the next section, we describe in detail the possibilities this has for academic and scientific development, and how these developments can be positioned against the growth of artistic expression, what we refer to as Funology.

4.2 Extension of Awareness and Recognition

This next sections examines the two experiments described above based on both their complexity and creativity. We hypothesize that lovers of complicated music have increased choices of probability. According to Meyer's theory, an experienced listener can predict more future possibilities for where a piece of music will go. The listener feels joyful when results betray that expectation. It involves more reasoning skills when there are diverse states of being.

Marvin Minsky, a leading expert in artificial intelligence research, explains human reasoning, defining the ability to detect certain kinds of differences at a conscious/unconscious level as a 'difference-engine' [21]. He defines this 'difference-engine' as reasoning at the conscious/unconscious level. He also points out that the function of the 'difference-engine' decreases as humans use that function throughout the day. Minsky assumes that music plays a role in returning human reasoning to its original conditions: he writes that listening to music is one way to restore this function. The word *music* here, of course, refers to music with a melody or harmonic structure. However, humans have transformed music into something more complicated and with complex acoustic representation. Music that has undergone such transformation disappoints the majority of listeners when they first listen to it, as the structure itself is complicated. For example, 'Risveglio di una città', composed by Russolo, and 'Le sacre du printemps', composed by Stravinsky, are typical examples. This music greatly deviates from previous music of its time, it the pieces' complexity disrupted listeners' reasoning.

Music during the Baroque Period was often styled on variations on 'La Folia', a musical piece composed of sequential variations on a theme with a fixed form of the melody positioned at the beginning. 'La Folia' implies that musical performance used to include more improvised elements than it often does at present. As this variation progresses, deviation from the original theme 'leaves the ordinary'. Playing with this deviation from the norm as a form of madness, 'La Folia' reaches the peak of musical ecstasy. When such music betrays listener's expectation, it exists outside the area that he/she can comprehend: there is a large amount of information his/her consciousness cannot handle, and he/she can grasp only a part. 'La Folia' is the plural of the French *foli* (madness/deviation) and references human madness or abnormality, an idea that began with Michel Foucault's concepts of psychological/pathological analysis [22]. Foucault presents theories of who defines 'abnormal', and how the criterion for abnormality is set [23]. He points out the involvement of society and culture on the creation of abnormalities. This abnormality can be interpreted as a thing made from the difference of both poles of 'deviation' on the spectrum of what is 'normal' in society. The boundary also corresponds to each individual area of consciousness/unconscious.

Human beings have been trying to orient consciousness to the outside of itself since ancient times. In 1954, Aldous Huxley published his book *The Door of Perception* [24], in which he consumes a substance extracted from cacti roots, often consumed by Native Americans in sacred rituals. Huxley describes his experience in detail and writes his conclusions. The substances he takes are similar to mescaline and lysergic acid; consuming them gives rise to a state of conscious arousal and a sense that consciousness connects with information outside the self. Native Americans thought that it possible to engage with the universal world by taking this substance. Huxley's view is unique, however, in that he concludes that artists can reach this heightened state of consciousness without taking such any substances.

Tor Norreteranders studies the role of consciousness in his book, *User Illusion,* understanding it as a function to eliminate unnecessary information within a subject's environment [25]. Norreteranders insists that human consciousness can be recovered by looking at a tree's green leaves or the mountain ridgelines at sunset. Yet, despite their benefits, these landscapes have a high degree of complexity when contrasted with cities, which are artificially and geometrically constructed. In other words, eliminating unnecessary information also eliminates some of the richest sensory information. Norreteranders concludes his work with the belief that 'subliminal' parts of our mind (other than consciousness) make up the "sublime."

In recent years, scholars have hypothesized that a symptomatic schizophrenic thinking pattern is formed when symmetry is transiently strengthened at the symmetry of cognitive bias in human inference. When symmetry becomes stronger, the situation assumed by reasoning increases. In other words, assuming the possibility of every situation is also an assumption of an impossible situation. It can be regarded as synonymous with increased complexity in reasoning. Logical reasoning without symmetric bias is scattered, rule-based reasoning. When the 'loosely symmetric model' (LS) is added to that, the inference approaches human intuition. And when a 'rigidly symmetric model' (RS) is used, it becomes excessive inference and approaches delusion. What is 'proper' and what is 'excess'? Who decides the standard? How do individuals become conscious of it?

The observation of the boundary between human consciousness/unconsciousness is based on the theories exemplified in this section. Expanding the area of conscious to the unconscious may have played a major role in the formation of human culture. What supported the movement is an illogical inference unique to humans, because illogical human reasoning has a higher degree of complexity than other animals, which perform only logical reasoning. It is reasonable that irrational behaviors became a source of artistic ideas, which may have been triggered by illogical reasoning in human history. From such a viewpoint, the increase in complexity in the music structure and the increase in complexity in human reasoning may have occurred in the course of the transformation of human culture. This implies that to be 'artistic' is to have rich ideas or make connections between human intuition and delusion.

4.3 Deconstruction of Belief

Imaging having a conversation with someone that goes something like this: 'Do you like music?' 'Yes, I like music'. What kinds of things are you associating with the word *music*? For example, if someone listens to Indian music every day, the words 'I like music' are insufficient, and an additional explanation is necessary to make clear that 'music' refers to 'Indian Music'. Likewise, if someone listens to concrete music, misunderstandings will arise if they merely use the word 'music' to communicate this.

In other words, *music* is often used in an implicit and limited way. In many cases, the word *music* refers to the most frequently played, best-selling, and most famous music that is liked by the majority of people. Most of this music is quite different from the concrete music we study here, and in most cases is composed based on Western traditional music theory.

Needless to say, this music plays an important role in connecting people's minds. Because music can invite consensus, it can arouse overall united group brain activity [26, 27]. Some even suggest that music may have been learned prior to language [28]. However, our workshops show that other kinds of music can have these benefits too, even music that many people may question as such on first listen. J. P. Guildford, the founder of personality psychology, defines the necessary attitudes for creativity [29]. His definition, specifically the following three traits, has a great influence on our study in this paper. These traits include directing diversity, tolerance to rules, and diffusion type with creativity rather than convergent type. Because electroacoustic music, which we use in our study, is based on creating non-rule-based music, our workshop encourages participants to assume more complexity than they would normally expect in regular music.

Using these assumptions, it is possible to clearly show that (i) people can learn to make highly complex concrete music, (ii) the creation of art is more diverse than many people assume, and (iii) a software system based on Berlyne's proposed inverse U function can be used to vary the hedonics point and further the field of Funology. Points (i) and (ii) attempt to extend the scope of the word *music* and enable us to be conscious of the circumstances compelling us to 'buy existing music and listen'. It enables us to transition from thinking of music as something given by society to something we create. Point (iii) demonstrates how computers can be applied to entertainment in order to further expand the framework of 'entertainment'.

In order to further examine the possibilities of the above three conclusions, we are preparing to integrate our past studies and put together a large-scale study that combines the creative field with empirical research. This will allow us to explore the possible connections between art and science, or the field of Funology, through a new acoustic expression applied computer. Moreover, the development of such a tool can be synchronized with the development of Funology in the anthropological field.

5 Conclusion

In Japan, contemporary music, including electroacoustic music, is still fairly marginal. However, we are convinced that this kind of music, generally regarded as esoteric, has the possibility of being enjoyed by many people. We offer a new way for people to appreciate this music—not just the general listening of music, but the actual creation of music. This topic is not novel: the popularity of amateur bands, global expansion of karaoke, and movement of 'handmade' 'zines' demonstrate that many people are now expressing their own creativity rather than merely appreciating the work of 'professional' artists.

However, our approach is fundamentally different from that amateurs expressing their artistic side, such as works like *The Portsmouth Sinfonia* or other outsider art. As computers become less expensive and more easily obtainable, we believe that increased creativity make everyone creators of their own art. Therefore, our research is directed at the transition from ‘appreciators’ to ‘creators’, a recent proposal within the art field that expands people’s enjoyment of works of art. We do not deny that the idea of ‘things that can be enjoyed’ already exists. However, we think that to extend this premise is useful for developing computer technology related to human entertainment. The effects and evaluation methods for such participatory workshops have not yet been established, and it is necessary to complete much further research in order to verify how these workshops can contribute to society. For that purpose, we are currently working on the following studies: (a) design of an electroacoustic music generation system that can control complexity, (b) development of a concrete music composition workshop and evaluation methods for the workshop, and (c) quantification methods for improving creativity and *kansei*, or ‘human sensation, expansion’. Putting together (a), (b), and (c), we call our future research the ‘Denshi Onkyo People Project’. The words *denshi onkyo* are Japanese and refer to electroacoustic music. This enables environmental design that can address both the creation and activation of creative fields and the formation of a place within the academic canon.

In the future, we hope to expand the field of our studies to Germany, the Netherlands, France, and other countries. We are preparing to acquire scientific data from each nation and compare the results. By doing so, we can verify whether our findings are particular to Japan’s social and cultural background or whether this is a global phenomenon.

Increasing the number of people who can enjoy esoteric music may help boost social innovation. Enjoying esoteric music, that has high complexity increases the number of assumable inferences, and by increasing such individuals, we also expand the areas that society can assume. Finally, many people can share their ideas in the enlarged hypothetical area. Of course, in order for such fluid creation of artwork to become the established social order, it is necessary to form a certain equilibrium between the intention to increase complexity and to suppress it. However, if we inductively grasp the possibility that as many as people as possible will be subjective and creative, it is reasonable to think that the proposals in this paper have the possibility of helping arouse social innovation.

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