THE SONIC CHARACTERISTIC ABOUT ELECTRONIC INSTRUMENTS THE TIMBRE'S STRUCTURAL FUNCTION IN ELECTRONIC MUSIC

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Fengjian

INTRODUCTION

The timbre is one of the important elements in music. Its importance should not be underestimate especially In electronic music. In fact, the human being began to explore the timbre and acoustics indefatigably since music has evolved. Before the 20th century, the position of the timbre was far inferior to "the up-and-coming youngster", such as harmony, tonality and subject, etc., while merely a part of "makeup man" who whitewashed the music works.

Begun in late romantic, the position of timbre in the musical compositions has become more and more significant. A large number of composers, like Wagner, Debussy, Stravinsky and Schoenberg, had successfully explored the usage of timbre and the design of acoustics in different orientations or at different levels. But the explorations were fairly in part. The function of the timbre, in composers' compositional conception, reminded a "palette" that added color to the composition. The structure of music reminded to be hold together by the specific note-relations, such as harmony, tonality, core interval, note row as well.

The timbrization of compositional conception has progressively evolved after the 1950's. The timbre has gradually held the post of the structural function that used to be held by harmony, tonality, and subject. It merits our attention that the timbre's usage in this period, was presented in unconventional fashions that kept along with the breach of traditional techniques, such as harmony, tonality, and the development of subject. In most of the electronic musical compositions today, the timbre coexists peacefully with traditional techniques of expression, except that it acts as a more important part unconsciously in the organizing process of the compositions. What is the reason for it? We should look for the key in the sonic characteristic of electronic instruments.

THE DISTINCTIONS OF SONIC CHARACTERISTIC BETWEEN ELECTRONIC INSTRUMENTS AND ACOUSTICAL INSTRUMENTS

We should compare the sonic characteristic of electronic instruments with the acoustical instruments' if we want to explain what it is. The acoustical instruments are the main media for producing sound in acoustical music, while the electronic instruments are the main media in electronic music. Because of their essential distinctions that exist in their principles of producing sound, these two kinds of instruments have the distinguishing features as below: (We just take the instruments in the Western orchestra and the contemporary electronic keyboard instruments

as the objects of comparison.)

1. The distinctions of the pitch property between the two kinds of instruments.

In most acoustical instruments, the pitch random is higher than that in the electronic instrumentss, and the pitch tendentiousness is easy to be handled in real-time. The pitch parameters in the electronic instrumentss are designed beforehand in the modulating process of timbre. Its frequency of pitch is represented by the pre-made precise value. Its flexibility of dealing with the pitch tendentiousness in real-time is less. Nevertheless, the pitch value of it is more accurate. This accuracy will not be impaired even though we increase the random of pitch variations through the random functions of pitch variation, or the pitch variation methods such as pitchbend, aftertouch, etc.. Dealing with the compositions that consist of microtones temperament, the electronic instruments are more than equal to ensuring accurate intonation, while the acoustical instruments are unable to do it so well.

The range of electronic instruments, in addition, is wide beyond compare. As the physical conditions, the effective range of many acoustical instruments is unable to exceed four (even three) octaves, except the keyboard instruments. The range of various timbres in the electronic instrumentss is utterly wide. Most timbres have an effective range of eight, even nine ovtaves.

2. The property's distinctions of homo-timbre's notes-join between the two kinds of instruments. (Homo-timbre means the sonic characteristic produced by triggering the same object in the same way. The relation, for instance, between a soft arco timbre and a hard one, belongs in homo-timbre, while the one between arco timbre and a pizzicato timbre belongs in hetero-timbre.)

The color variations of homo-timbre in the acoustical instruments are complicated and exquisite. And because of the differences of the performers' technique, style, and the comprehension to the compositions, the random of timbre variations is higher, and the connection of notes is closer. The variations of homo-timbres in the electronic instruments, as the pre-made property of sonic parameters, are more uncomplicated. The independence of successive notes is strong.

3. The distinctions of the overtone-produced mode between the two kinds of instruments.

The overtone, produced by the acoustical instruments, is the natural result of vibration process. This result agrees with acoustical principle. The overtone, produced by the electronic instruments, comes from the digital calculation and comes along so many man-made elements.

As we play an open note on violin, for example, the first upper partial is produced by the vibration of 1/2 of string, the second one by the vibration of 1/3 of string as well. On many types of synthesizers, the frequency of each upper partial is the man-made value, and is produced by a relatively separated oscillator.

The volume rate of the notes' upper partials, in the acoustical instruments, would be changed in the sustenance process of sound. That is caused by the subtle disparities of natural resonance and/or the triggering mode. But that's different on most electronic instruments. Each upper partial, once triggered, would sustain with the permanent value. The volume rate of the notes' upper partials would not be changed any more in the sustenance process of sound.

So when playing a single note, the sustained sound in the electronic instruments does not change with the difference of physical conditions, like that in the acoustical instruments. When playing a chord, the different notes produced by the electronic instruments do not unite into a blended whole as easily as those produced by the acoustical instruments. The clarity and perspective sense of each voice would be better, since

each note is in a separated and independent condition.

4. The distinctions of the hetero-timbre's mutual relation between the two kinds of instruments. (The hetero-timbre of the acoustical instruments means the distinct sonic characteristics that produced by the different objects or variant triggering modes, and the hetero-timbre of the electronic instruments means the ones that produced by dissimilar waveforms.)

The hetero-timbres' variations are limited in the acoustical instruments. To a certain extent, it presents *the property of development*. The hetero-timbres' variations are limitless in the electronic instruments. To a high degree, it presents *the property of contrast*.

For instance, some *inter-bridges* exist in most of the hetero-timbres in the orchestra: the viola is the bridge between the violin and the violoncello, the horn is the one between the trumpet and the trombone, etc.. The hetero-timbres' variations in the electronic instruments, however, are ordinarily created by the transformation of waveforms. This transformation is a more direct change of the sound quality.

Therefore, the whole sound effect in the acoustical instruments, sounds good at harmonious degree, but the contrast of the hetero-timbres seems not so intense as that of the electronic instrument. The whole sound effect in the electronic instruments has separated sense and perspective sense. The contrast of hetero-timbres is obvious and easy to distinguish.

The timbres of the electronic instruments are able to embody a space-effect that oversteps the real performance place. Various timbres played in a same locale can achieve a totally different space-effect. On the other hand, the acoustical instruments are just dependent on the real performance place. Various instruments played in a same stage can only get the same space-effect.

5. The distinctions of the volume property between the two kinds of instruments.

The volume of the acoustical instruments is the natural result of the instruments' vibration in the air. The volume disparities of the different kinds of instruments are much great. However, the volume of the electronic instruments is the hand-controlled result. Various timbres' volumes have no natural disparities.

Now that there are so many distinctions of acoustical characteristics (or timbre characteristics) between acoustical instruments and electronic instruments, we can reach the distinctions of musical tongue in both of those.

THE DISTINCTIONS OF MUSICAL TONGUE BETWEEN ACOUSTICAL MUSIC AND ELECTRONIC MUSIC

1. In the acoustical instruments, the pitch random makes notes-join fluent, the expression of tonality-sense and modal-sense pretty well. Thus the acoustical instruments are fit for the music tongue that based on the complex relation of pitches. The electronic instruments are short of the distinct tendency of various intervals. This tendency is in need of different tonality and mode. The relations of various pitches are more stable and accurate. Besides, the electronic instruments have a wide range. Therefore, this kind of instruments is even more fit for the tongue with simple pitch relations and more motive-type elements. Moreover, each timbre is capable of assuming any voices flexibly, and been unrestricted by the range.

2. The random of homo-timbre variation, in the acoustical instruments, makes the relation of tone-color and the association of expression closer, especially in melody performance. But in the melody performance that with

the electronic instruments, we can hear the more independence of notes. In other words, the acoustical instruments are good at the melodies with delicate expression, smooth flavor, plentiful speaking-sensation and human-touch. The electronic instruments, however, are fit for the materials that the notes' relation is relatively independent. These materials include the phrases with pellet-sense, the patterned figures, etc.. They are suitable for the concise methods in development. These methods alter and repeat the pitch and rhythm of the materials. And then, this nearly precise repeat of sonic characteristic is helpful to make up the timbre's dominant function.

3. The distinctions of the overtone-produced mode and the distinctions of the pitch random between the two kinds of instruments exert influence mainly upon the harmony tongue. The consonance of harmony in the acoustical instruments is higher than that in the electronic instruments. In the case of playing a same chord, the one performed with the acoustical instrument is more consonant, more acceptable by ears, more appropriate for the abundant connotation of harmony tongue, than the one performed with the electronic instrument. Thus, the acoustical instruments are fit for the tongue of achieving structural force by harmony methods. The dissonant sensation in the electronic instruments is more than that in the acoustical instruments. This makes the coherence, sequence, and the harmonious degree, cohesive force, that the electronic instruments can bring about in horizontal harmonic sequence and vertical chord disposition, far less than what the acoustical instruments can do. This also makes the voice arrangement more distinct, the voice character more explicit, and the transparent texture easier to form. In other words, in the harmony tongue of electronic music, the harmonic function that is of traditional significance withdraws to second place, and instead of the transmitting function that expresses the voice character. Therefore, in many compositions of electronic music, the intentions of harmonic means are for organizing voices, adding colors, but not for gaining the driving forces of harmonic sequence.

4. There is a close relation existing in the timbres of various acoustical instruments. So, in the timbres of acoustical instruments, there are more properties of development and mixture than properties of contrast. In the electronic instruments, the timbres' characters are more striking, and with more properties of contrast and independence. This feature of distinct character makes the capability, that expresses musical connotation by the timbre means, in the electronic instruments far greater than that in the acoustical instruments. Furthermore, the feature of sonic parameters' prefabrication in the electronic instruments, that is the feature of great plasticity towards timbre, makes the variations of timbres an unlimited possibility. The space-effect property also makes the variations of timbres more varied and colorful. Therefore, the electronic instruments are even more suitable for the tongue based on timbres' variations than the acoustical instruments.

5. The complicated relations of the volume rate in the acoustical instruments, make the composers paying great attention to the volume balance of various timbres when they compose the orchestral pieces that with complex timbre combinations, in an attempt to get good combinations of various timbres. Nevertheless, since the volume difference is too great, it is not the case that each mode of timbre combination could get the volume balance. Especially when it is fortissimo, some combinations of timbre would have no actual applicable value because of the grave overbalance of the volume rate. While on the other hand, the volume in the electronic instruments is a hand-controlled parameter. The relation of the volume rate is exceedingly simple. The problem of volume balance does not exist in any of the timbres' combination. Therefore, the possibility of timbres' combinations in the electronic instruments is far greater than

that in the acoustical instruments. This provides a boundless area of the timbres' usage for the compositions of electronic music.

(Because of the limited space, the following analysis part of electronic musical pieces that tests the structural function of the timbre is left out.)

CONCLUDING REMARKS

To sum up, we can notice that the sonic characteristics in the acoustical instruments make the instruments well up in discovering the specific relations of notes. The harmony, the tonality, the constitution and development of subject, are all based on the specific relations of notes. In this respect, the electronic instruments are not as flexible as the acoustical instruments. If remarking that the tongue of acoustical music makes the notes existing in the dependence upon each other, then the tongue of electronic music makes the notes existing in the contrast to each other.

Nevertheless, the electronic instruments have its own specific characters that are incomparable to the acoustical instruments: that is its unique expressive attribute of timbre. These specific characters also contain: the stable and accurate pitch relations (even if for microtones temperament it is still accurate), the wide range, the striking characters of timbre, the boundless variations of color, the easy-to-controlled volume rate, and so on. All these characters, that have direct bearings on the sonic characteristics, enrich extremely the connotation of timbre tongue in electronic music, and also increase the expressive attribute of timbre.

The composers of electronic music accomplish the needs of musical expression, just by applying this unique expressive attribute of timbre on their own initiative. We can see in many compositions of electronic music today: the timbre methods, such as the increase and decrease of acoustical thickness, the adding and lessening of timbre amount, the contrasted application of various timbre kinds, etc., become the effective technique in the development part. The unity of the timbre usage, that applies in the beginning and the end, also becomes the effective technique in the structural integration. In short, the timbre and the various measures correlated with it, play a leading role, that should not be underestimate, in the structure and expression of electronic music.

In a word, the electronic music, that takes the electronic instruments as the sounding media, is more suitable for the compositional conception mode that regards the timbre as the starting point for the musical design. In other word, this mode, which emerges as the demand of the sonic characteristics of electronic instruments, is: taking the timbre as the most important character of the subject's constitution and development, and entrusting it a particular significance at the level of musical structure.

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