

Japanese Traditional Orchestral Music: The Correlation between Time and Timbre

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RÉSUMÉ

Contexte en Musique

Temps: Le concept traditionnel japonais de temps met l'accent sur le présent. Le passé et l'avenir sont remplacés par l'éternité et une emphase sur l'instant présent. Ceci se manifeste en musique, entre autres, par une extrême lenteur à la limite de l'immobilité.

Timbre: L'orchestre de la Cour impériale japonaise est un ensemble hétérogène divisé en trois groupes: bois, cordes et percussion. Chaque groupe a sa propre fonction qui est strictement prescrite: le bois présente la mélodie, la percussion marque les unités de temps alors que les cordes joignent ces groupes en colorant certains tons mélodiques. La superposition de ces trois couches crée un composé non fusionné ou chaque timbre est clairement perceptible.

Contexte en Acoustique

Hermann Von Helmholtz (1821-1894) a établi qu'un son complexe qui émet une hauteur précise est généralement composé d'ondes périodiques et que la fréquence de chaque onde doit être en rapport de nombre entier avec une fréquence fondamentale, telle que révélé par la Transformation de Fourier. Bien que le rapport entre les partiels de certains sons complexes comme celui du piano ou des instruments à cordes pincées, exhibe un certain degré d'inharmonicité, le rapport entre les partiels des instruments aux sons entretenus est toujours harmonique. Enfin, les chercheurs ont aussi démontré que notre perception du timbre d'un son est affectée par: la quantité d'harmoniques du son, la distribution d'énergie entre ses harmoniques et la position de certaines zones fréquentielles de résonance privilégiée. L'analyse spectrale est une des méthodes utilisées pour obtenir cette information.

Objectifs

En tant que compositeurs formés dans la tradition classique occidentale, il ya deux éléments de la musique traditionnelle japonaise que nous trouvons particulièrement frappants: l'importance du timbre et l'extrême lenteur du temps. Dans cet article, nous tenterons d'expliquer l'interrelation qui unit ces deux particularités. Nous commencerons par résumer certaines notions temporelles qui sont propre à la culture traditionnelle japonaise. Nous expliquerons ensuite le rapport entre les propriétés acoustiques des instruments et la structure orchestrale figée et stratifiée décrite sous la rubrique «Contexte dans la musique». Pour illustrer notre point de vue, nous ferons référence à *Etenraku* qui est la pièce de référence dans l'enseignement de la musique du *Gagaku*. Finalement, nous élaborerons sur la manière dont le timbre, les propriétés acoustiques des instruments et les techniques orchestrales japonaises concourent pour créer cette expérience temporelle typiquement japonaise.

Contribution principale

Nous avons extrait des échantillons d'instruments isolés d'un CD commercial du *Tokyo Gakuso*, un ensemble dont la renommée internationale est bien établie, et nous avons analysé la partie d'entretien de ces sons. Nos analyses spectrales ont montré qu'à l'opposé des instruments occidentaux, les instruments du *Gagaku* ne respectent que partiellement l'idéal occidental de fusion. En fait, elles révèlent que les fluctuations de hauteurs qui font partie du mode de jeu de ces instruments, empêchent le son de ces instruments de fusionner. De plus, les techniques compositionnelles de l'époque comme l'hétérophonie et l'attribution de rôles divergents aux instruments, ont accentué l'absence de fusion dans cette musique. Notre document montre une corrélation entre cette approche du timbre et cette emphase sur le présent comme étant comparable aux attributs du temps non-linéaire.

Implications

Comprendre comment écouter la musique de *Gagaku* est une des premières étapes possibles vers une appréciation de cette musique qui date de plus de mille ans, et qui demeure relativement inconnue du grand public, même au Japon. L'étude de la relation entre le temps et le timbre dans la musique japonaise contribue également à révéler par le biais de la comparaison comment ces deux éléments fonctionnent dans d'autres cultures.

1. INTRODUCTION

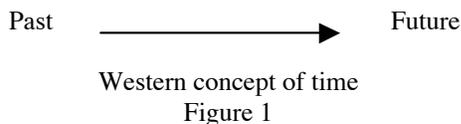
To listeners educated in Western classical tradition there are two features of Japanese traditional orchestra music that seem particularly striking: the foremost emphasis on timbre and extreme slowness of time. The goal of this article is to show how the two are correlated. The analyzed example comes from *Etenraku*, an emblematic *Gagaku* piece from the *Kangen* repertoire of purely instrumental music.

The first part of the article will describe the concept of time by contrasting it with its Western counterpart and by discussing specifically Japanese cultural and aesthetic notions that underlie it. Certain generalizations will be made in full awareness that no culture's music is completely uniform. The second part will focus on the analysis of orchestration techniques and acoustical characteristics of *Gagaku* instruments to show how different elements of timbre contribute to the creation of this distinctive time experience.

2. TIME

2.1. Western concept of time

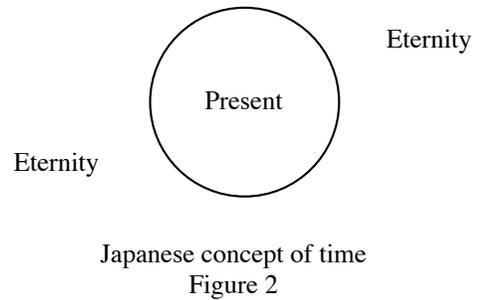
The traditional Western concept of time is linear [1]. It can be represented by a vector coming from the past aiming at the future, as shown in Figure 1.



Western way of thinking about time frequently emphasizes the past and the future to the detriment of the present. The notion of the present is vague and relative. It may consist of very specific events but each of them individually is of no great importance. What seems to matter is how the present brings us from the past to the future. Such approach to time involves constant movement between distinct positions through a succession of more or less ephemeral points. Whether it is in terms of harmonic or melodic development the listeners expect a progressive motion forward or a constant cycle of implications and realizations [2].

2.2. Japanese concept of time

In contrast, Joji Yuasa describes the traditional Japanese concept of time as circular [3]. It is illustrated in Figure 2.



In such depiction the time vector is absent. The Japanese's way of conceptualizing time emphasizes the present to the detriment of the past and the future. Through a focus on 'now' the listeners experience eternity. Every musical event is equally important, and in constant and gradual transformation but without leading to any destinations such as a climax. The end result is a steady continuum that gives the music an impression of staticity and slowness.

Among the cultural and aesthetic notions that define the Japanese concept of time three seem particularly important: *ma*, *naru*, and *jo-ha-kyū*. They will be described individually as each sheds light on a different aspect of time.

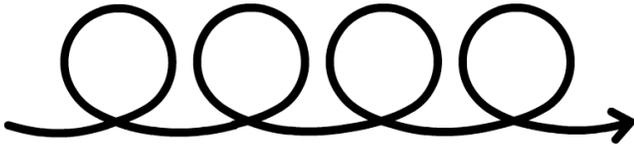
2.2.1. *Ma* (time or space interval)

Ma literally refers to the space between elements or time interval between events. It is a primary measure of artistic expression. On a fundamental level it governs the very central element of musical performance: the sense of rhythm. It is not a mathematically calculated interval, but rather a sensory and intuitive one. *Ma* implies also that the space between events is equally worth attention as the events themselves. As a consequence, in Japanese concept of time durations have also a dimension of depth.

2.2.2. *Naru* (becoming)

The notion of *Naru* underlies the Japanese traditional cosmology. Akira Tamba [4] states that its most important aspect is the idea that things and beings are continuously and gradually evolving. There is no singular moment of creation or death. Everything incessantly evolves and becomes. As such, *naru* confirms that past and future are part of the Japanese-Time reality, but not as points of focus. It entails that the Japanese perceive time as more fluid than Westerners; it cannot be divided into discrete, calculable points; it can only be grasped through its motions. While for a Westerner the lack of salient events may lead to a feeling of general slowness, *naru* does in fact add motion to the Japanese concept of time. According to it the 'now' is not an unchangeable or recurring moment, but rather a continuous succession of

moments of becoming. Hence the Japanese concept of time could be redrawn as in Figure 3.



Naru and the Japanese concept of time
Figure 3

2.2.3. *Jo-ha-kyu* (a succession of formal stages)

Jo-ha-kyu is a primary and ubiquitous principle of formal construction in Japanese arts [5]. It frequently describes the musical development on all formal levels. It can govern the structure of a musical program, the form of a piece, the development of a section, musical phrase or even of an individual note. It can be roughly translated as: *jo* = slow introduction, *ha* = faster build-up and *kyu* = fast conclusion. It is traditionally understood as a constant but extremely gradual, sometimes almost imperceptible acceleration of the music. On a highest formal level the different sections maybe clearly delineated as representing one of the three but when applied at lower levels the principle becomes more vague and implies mostly the slow change of tempo and a constant transformation from relatively formless introduction through more defined development to a fast rushing into a breakup. Taken this into account the symbolic depiction of the Japanese concept of time should be redrawn further as in Figure 4.



Jo-Ha-Kyu and the Japanese concept of time
Figure 4

In conclusion, the Japanese concept of time can be seen as circular and focused on now. Its overall structure is relatively static and slow but the temporal fabric of each individual moment is dynamic and multi-dimensional.

3. TIMBRE

3.1. Timbre and Vertical Time

Jonathan Kramer labels the form of time that emphasizes the present as 'vertical time' [1]. Considering that vertical organization of pitches and instruments relates respectively to harmony and orchestration - two attributes of timbre,

Kramer's statement suggests that form of time focused on the present must favor a stronger sensibility toward timbre. This is confirmed by the importance of timbre in Japanese orchestral music. The following analysis will trace the parallels between the treatment of timbre in *Gagaku* music and the static and dynamic facets of Japanese concept of time.

3.2. Static timbral characteristics

The large scale level staticity and slowness of *Gagaku* music is strongly reflected in the approach to three primary aspects of timbre: the stability of orchestral function of the instruments, predictability of orchestration over time and the constant dynamic level.

The instruments of the Japanese Imperial Court orchestra can be divided into three choirs: woodwinds, strings, and percussion. Each choir has a prescribed function that is never altered. The oboe (*hichiriki*) and the flute (*ryûteki*) from the woodwind choir present the melody. The percussion choir consisting of a small two-headed drum (*kakko*), a large hanging drum (*taiko*), and a small gong (*shôko*), collaborates together to create a single rhythmic pattern, which marks off time units. The last group creates a bridge between the woodwinds and percussion by coloring key unpitched percussive attacks with pitched motives and harmony related to the melody. This group consists of the two plucked string instruments: the zither (*koto*) and the lute (*biwa*), and the remaining woodwind instrument - the mouth organ (*shô*). To start appreciating this unique timbral characteristic of Japanese music, one should imagine a symphony with all melodies played exclusively by the flute and oboe accompanied solely by the string instruments. The next step would be to transpose the same idea to a large body of symphonies.

The orchestration of every *Gagaku* piece is highly predictable in the beginning and ending sections and entirely static for the rest of the time. The form of *Etenraku* is constructed with three melodic materials (A, B, and C) each eight measures long. Materials A and B appear four times, while material C appears two times according to the following formal design: AABBCCAABB. Since there is no tradition of melodic, harmonic, rhythmic, or orchestral development in this music, the material and orchestration of the sections are simply repeated, with the exception of the first and the last sections, which respectively act as a gradual fade-in and a gradual fade-out. The instruments' entrance in the introduction follows a strictly preset order: the *ryûteki* enters first, followed by the percussion instruments, the *shô*, which enters quasi-simultaneously with the *hichiriki* and finally the *biwa* and the *koto*. Once the full ensemble is playing, all instruments are present until the coda, during which instrument disappear following another preset order. The percussion stops first, followed by the woodwinds, finishing with *biwa* and *koto*.

The staticity of *Gagaku* is found also in its approach to dynamics. Disregarding the introductory and closing sections, the remaining sections are all played loudly in a constant dynamics.

To summarize, most of the time *Gagaku* music is played by the full ensemble, with the flutes and oboes repeating the melodies over the static rhythmic patterns of the three percussion instruments, accompanied by a harmony played by the two string instruments and the mouth organ. Hence, the returns and even changes of sections do not create momentum or expectation of a climax, instead they create a sense of *déjà-vu* and an impression of motionlessness. The large-scale approach to timbre reinforces the feeling of circularity of time and illustrates well the constancy of eternity.

3.3. Dynamic timbral characteristics

Whereas the overall timbral surface of Japanese orchestral music may appear static, its inner life is dynamic. The textures are non-blending and complex and every moment seems to have depth. This is a result of stratified organization of instruments into registers, the destabilization of melody through heterophony as well as the non-fusing acoustical properties of the instruments.

3.3.1. Distribution of instruments through registers

Separating instrumental choirs through register prevents them from blending, hence creating a multilayered texture, that adds depth to the overall timbre. This is the case in *Gagaku* music where pitched instrumental families occupy different strata as shown in Example 1. The string instruments occupy the lower register; the *koto* one octave above the *biwa*. The woodwind instruments placed one octave higher than the *koto* occupy the higher register. The *hichiriki* and the *ryûteki* are voiced an octave apart, overlapped by the *shô*.

3.3.2. Heterophony

The non-blending quality of the Japanese orchestra is reinforced by the use of heterophony. It has been demonstrated that the ability to hear separate parts is increased when they are not synchronized rhythmically [7]. Example 1 shows the first phrase of *Etenraku*'s section B. In measures 2-4 the two woodwind instruments present the same melody while using different rhythmic values. The two string instruments also differ: the *biwa*'s main rhythmic and melodic motion takes place on the downbeat of every measure, while the *koto* becomes more active on the second and third beat of every second measure.

Pitch analysis shows that the heterophonic technique leads to moments of consonance alternating with dissonance. The first measure is a moment of consonance. The arrows in the example point to instances of the tone

'B', which in almost all instruments arrives in rhythmic phase. Note that traditionally the lowest pitch of the *shô* and the highest on the *biwa*'s are considered their principal melodic tones. The *koto* is the sole instrument to play its melodic 'B' out-phased from the other instruments. On the other hand, the third beat of the second measure shows how the heterophonic technique adds color and texture to the melody. The 'A' in the *hichiriki* matched by the *shô*, 'clashes' with the F# and G of the *ryûteki* and *biwa* respectively, transforming the melody into a harmony. This kind of treatment of melody seems to enhance primarily the timbral quality of the music.

Etenraku – Simplified score of the first phrase of Section B
 (For a more precise and detailed version please refer to Shiba [6])
 Example 1

3.3.3. Acoustical Properties

The examination of the acoustical properties of *Gagaku* instruments suggests that an important reason for the non-blending quality of the ensemble is intrinsic to the instruments themselves. This will be shown through the analysis of two most important physical characteristics of sound used in the determination of timbre: the attack and the waveform of the steady part of the tone.

The types of attack of the eight *Gagaku* instruments vary widely, rendering sonic fusion more difficult. For example, in Western orchestra one can observe that the uniformed sound of instruments of the string choir fuses better than that of the woodwind choir, since the latter involves three different types of embouchure. The eight *Gagaku* instruments, made of varying materials, produce their sound using eight different qualities of attack, by means of diverse types of embouchure plucking methods, and hitting strokes -

Woodwind instruments:

- *hichiriki* is a double-reed instrument with an embouchure similar to an oboe,
- *ryûteki*'s embouchure is similar to a Western transverse flute,
- *shô*'s embouchure is fully covered by the performer's lips. The air blown by the musician through the embouchure activates an internal free reed.

String instruments:

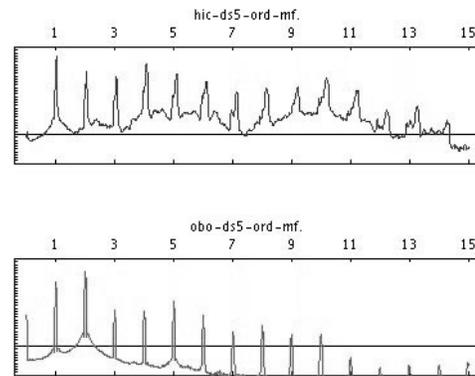
- the plectrum used to stimulate the *biwa*'s strings is large, triangular and made of wood; the performer holds it in his/her right hand and uses the pointed edge to pluck the strings,
- the *koto* player attaches three small rounded shape plectra to his/her right hand's thumb, first and second fingers; plectra used to be made of ivory, but today plastic is used instead.

Percussion instruments:

- the *taiko* is a membranophone played with a large rubber mallet,
- the *kakko*, also a membranophone is played with wooden sticks,
- the *shoko*, the sole idiophone is also played with wooden mallets.

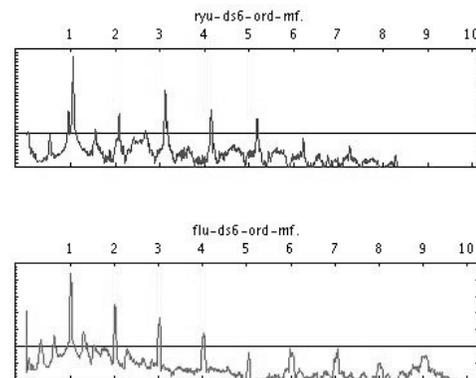
Second factor that weakens sound fusion is the acoustical property of the sustained parts of sound of the melodic instruments. The spectral analysis will show that the timbre of *hichiriki* and *ryûteki* is fairly unstable rendering their fusion more difficult. Figures 5 and 6 present the averaged harmonic spectra of the steady part of the tone of the two instruments with their Western counterparts. The duration of the analyzed sustained parts was of 1.5 seconds. Figure 5 shows the averaged harmonic spectra of

a Western oboe and the *hichiriki* playing a D#5 *mezzo-forte*. A comparison between the two reveals that the *hichiriki* has a richer spectrum than the oboe. The *hichiriki*'s thicker harmonic peaks indicate that the fundamental frequency fluctuate substantially. Finally, the amount of energy surrounding partials four, five, six, eight, nine, ten, and eleven imply that its sound includes a fair amount of noise. Figure 6 is a comparison of the averaged harmonic spectra of *ryûteki* and the Western flute playing D#6 *mezzo-forte*. It shows that the *ryûteki*'s fundamental does also fluctuate although less significantly than the *hichiriki*.



Averaged spectra of two instruments playing a D#5
Top: Japanese oboe (*hichiriki*)
Bottom: A Western oboe

Figure 5

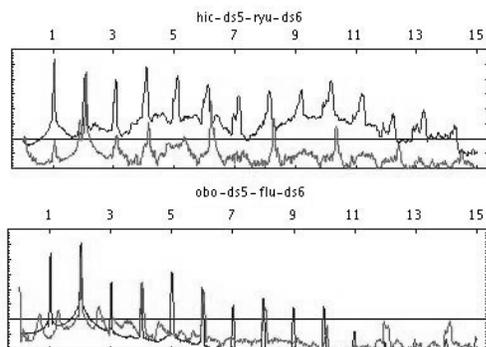


Averaged spectra of two instruments playing a D#6
Top: Japanese flute (*ryûteki*)
Bottom: A Western flute

Figure 6

It has been demonstrated by Albert Bregman that two tones blend better when more of their partials coincide [7]. The bottom part of Figure 7 superposes averaged spectra of the Western oboe (D#5) with flute (D#6). Their well-aligned corresponding partials suggest that the two sounds will blend. The top part of Figure 7 superposes the

hichiriki (D#5) with *ryûteki* (D#6). As anticipated, the offset between their corresponding ‘fluctuating partials’ reveals that these two sounds will not blend as well.



Top: Averaged spectra of the Japanese Oboe playing a D#5, and a Japanese flute playing a D#6.
 Bottom: Averaged spectra of a Western oboe playing a D#5, and a Western flute playing a D#6.
 Figure 7

3.4. Timbre and the Focus on Now

Like its Western counterpart Japanese orchestral music is composed of superposed layers of sound but while Western music layers usually blend, layers of Japanese orchestral music do not. The listener can at all times easily differentiate the sound of instruments across choirs as well as within each choir. An intricate and refined interaction between eight *Gagaku* instruments is clearly perceptible at every moment. This provides a complex and dynamic experience even if on a larger scale other elements appear slow or static. The richness of Japanese traditional orchestral music is not based on a high level dramatic progression but on the inner life of the ever-elusive moment. Emphasis on timbre and focus on the present seem to go hand in hand.

4. CONCLUSION

The traditional concepts of time and timbre in Japanese music are interrelated. The concept of time emphasizes the present, and as such shows a strong predilection towards timbre. We demonstrated that the approaches to time and timbre parallel each other in a matching dichotomy of static and dynamic elements. The analysis of *Etenraku*, the best known of *Kangen* pieces, demonstrated that on a large scale *Gagaku* music material is relatively static, which increases the degree of predictability and creates a feeling of slowness. As it lowers expectations for forward motion it allows the listeners to focus their attention on the present

moment where the analysis has shown the material to be intensely dynamic, heterogeneous and multidimensional. Timbre plays a crucial role in this experience as even music’s most important material - the melody, via its heterophonic treatment becomes a timbral component. This is served well by the acoustical properties of instruments, which as the spectral analysis has shown, do not blend allowing this transformation of melody to be clearly perceptible.

Future psycho-acoustical research may confirm a link between slowness and an emphasis on timbre. If one is to accept the perception of slowness in several significant genres of Japanese traditional music it is intriguing to learn that two prominent figures, composer Toru Takemitsu [8] and musicologist Yoshihiko Tokumaru [9], both point to timbre as a vital element of Japanese music. According to Takemitsu “... The Japanese are a people who have been endowed with a keen receptivity towards timbre from ages past.”

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