

For Dr. Theo Hirsbrunner

VOLUNTARY and SOMA; with / without “ pli ”

An analysis on “strie / lisse ” - conducting technique by Pierre BOULEZ 1

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Abstract

With physical, physiological and neural cognitive scientific background, various advantages of conducting techniques by Pierre BOULEZ have revealed. In this paper we propose a general new framework of human SOMATIC techniques of music, and control, intension based on VOLUNTARY, from “SERIEL” point of view, based on the pioneering contribution by BOULEZ, and try to draw an ESSQUISSE of the birds’ view of the situations to come. This article mainly deals with rhythmic articulation and its physical expression methods.

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Moris BLANCHOT had quoted a part of letter by René CHAR written in 1943, at the end of his “INTELECTUELLES EN QUESTION”.

*“I will never forget, being forced to become ... how long had it be... a monster of justice and intolerance, a close-hearted simple mind holder, a person with arctic heart who has no interest to anybody who do not league together for the fight against the Hell-dogs... The arrest of Israel people, the triumphant scene of threat in police office, the terroristic attacks of Hitler’s secret police to the panicing villages, all these make me to uprising from the ground, on my chapping face a stroke of red cast iron.”(1943) [*1]*

Emotion, action, or even certain kind of gesture easily changes the body of the actor, often before the self conscious cognition of the actors themselves, and make a series of quasi-automatic performance beyond the control of the actor's subjective mind. This is a strict, but not so popularly known physiological fact.

BLANCHOT also quoted in the same book the famous manifest by Th. ADORNO, "Never repeat the Auschwitz again". This point of view is utmost important and had much to do with the revolution of music in 1950's.

Most profound discussion of music is possible from this, and the author had worked on them for years. However it takes an amount to describe these all. In this paper we would like to eliminate specific problems of musical performance: the gesture of conducting and the importance of techniques by Pierre BOULEZ closely related to these above.

Also at the course of musical performance, corporeal techniques determine the quality of performance before the **CONSCIOUSNESS** of the performers themselves.

Pierre BOULEZ's conducting techniques are quite reasonable, rational and excellent from physiological, physical and neural-cognitive scientific background. We would like to show these advantages and the possibility of further extension of it to general methodology of music based on serial way of thinking. ■

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pierre boulez

Dear Ken Ito,

Many thanks for reading and your very interesting
study "Voluntary and Soma"

I learned quite a bit about the comparison of the gestures
of conducting, seen from a quite different point of view.

Best wishes

P. Boulez

April 6 2005

Message about this paper from Pierre Boulez. April 6 2005

1 LUCERNE LESSONS: Pierre BOULEZ's technique of conducting

1-1 Lucerne Festival Pierre BOULEZ Academy

On August-September 2004, an music academy under the name of Pierre BOULEZ was held in Lucerne Swiss. More than hundred young musicians gathered to the academy orchestra. Substantial programs form chamber music up to full orchestra were executed under the artistic direction of Pierre BOULEZ, together with executive and artistic direction of Michael HAEFLIGER, and members from ENSEMBLE INTERCONTEMPORAIN with Cliff COLNOT. During this period, master courses of piano with Maurizio POLLINI, and conducting by BOULEZ were also held, and the author took part in the latter. On 1995, at the occasion of Pierre BOULEZ Festival in Tokyo, the author could fortunately had opportunity to learn the details of rehearsal and techniques of conducting by BOULEZ, and through the experience of this time's master course, could understand the advantages of his method reasonably and with scientific background, and, moreover, the possibility of extending this to general wealth of music making based on physiological, physical, cognitive and musical principals.

The Repertoires of the conducting master course 2004 were as follows:

Anton WEBERN; Five pieces for string orchestra op.5 1st. mvt.

Hanspeter KYBURZ; Noesis 3rd. mvt.

Pierre BOULEZ: Notations 1, 2

About the analysis of the scores above, Hanspeter KYBURZ had a course, and about the practical techniques of orchestra conducting, Cliff COLNOT served a remarkable lessons before, and in between the orchestra sessions.

The level of students at the master course was generally at the highest.

However, still in the practical, and deep, techniques of the conducting there could be much to be pointed out in the inexperienced, young and talented conductors.

One of the basic points of conducting by BOULEZ is **ACCURACY** based on the throughout understanding of the piece.

AUDIBILITY is also one of the keys of the technique, for, with the incorrect performance, even if some important notes are written in the original score, it is quite easy to mask them.

Some historically important works which are not so frequently performed and consequently not so widely understood by players, are “unfamiliar repertoire” to orchestra, and those potential hazards described above are often observed.

Similarly, most popular pieces like some by Richard WAGNER, are known too much by players and here also, with different reason, fundamental structure of the music are easily hidden with “playing customs” or even with the name of “tradition”.

The discography of P. BOULEZ and legendary performances at BAYREUTH Festspiel clearly show the strength of his simple and throughout methodology for **AUDIBILITY** most eloquently.

But during the short, limited courses at Lucerne, it was simply impossible for all the young conductors to understand those details from the reserved, precious lessons by BOULEZ himself. This is why the author made up mind to write down these basics and background even during the stay in the beautiful lakeside city where WAGNER had composed important works.

1-2 Technical problems of typical young conductors

Pierre BOULEZ realizes the simple principles also at the corporeal levels of conducting throughout. However, it is simply impossible to young students to know, to understand and to change their inexperienced performance during the limited time of the master course.

Typical technical problems on rhythmic side are as follows:

- 1 Inaccuracy caused by careless up-beat**
- 2 Inaccuracy caused by careless division of single beat**
- 3 Inaccuracy caused by too much gesture**
- 4 Inaccuracy caused by physiological irrationality**
- 5 Other reasons based on solfage, rhythmic and misreading of the music**

In the following part we would like to illustrate those five above respectively.

1 Inaccuracy caused by careless up-beat

About the down beat, no significant problem were observed during the master course, for the students were well trained basically. However, still, about the up beat, inaccuracy of counting or unwilling, uncontrolled, non-arbitrary gap between subjective counting and observed gesture, misuse of body or musically wrong breath taking (these have the common root to “4”) were frequently observed in the course.

It is often criticized that Japanese method of conducting is too practical and mechanical: the author totally agree with such syndrome and indeed had struggled against such superficial pedagogy for years, but still, from such a Japanese point of view, there is much room of training in such basic techniques of conducting, and Pierre BOULEZ himself spends an amount of time for the correction of such skills, accurate counting

and simple gesture, and taught the fact that all these trifle things change the whole sincerity to music.

2 Inaccuracy caused by careless division of single beat

A similar basic inaccuracy occurs within unit beat, and similar correction were tried.

Pierre BOULEZ and Cliff COLNOT emphasized the importance of **PERIPHERAL VISION**, not the **CENTRAL**, of the players for the cognition of conductors' gesture. The central vision and attention of the players would possibly focus on the notes in the playing materials, or on ensemble making, instrumental conditions, and every other practical matter.

BOULEZ taught that simple and clear gesture would hold the accurate division of unit beat.

3 Inaccuracy caused by too much gesture

This is almost the same symptom to 1 and 2, and described from different angle. Most of young conductors had **EXPRESSED** too much with **EXCESSIVE GESTURE**, and send unexpected, non-arbitrary, inaccurate sign for the players.

Following BOULEZ's words were quite impressive; "The more you would like to express yourself, the less music and musicians express themselves."

4 Inaccuracy caused by physiological irrationality

This could be also understood in the same course of "3". For a student with much too **STRAIN** in his arm, BOULEZ advised simply to stretch the arm and suggested "**TO STAND BESIDE THE MUSIC**, not got involved too much into it." For another girl who kept much **STRESS** in her **SHOULDER** and **UPPER ARM**, and subconscious,

non-arbitrary habit of too much raising limbs upward, BOULEZ showed the fact that the very stresses would be the reason of non-controllability and ensemble breaking, and before the realization of flexible musical freedom, such misuse of body deprive the conductor's own freedom, and made correction to all of these.

5 Other reasons based on solfage, rhythmic and misreading of the music

Only one example would be enough for this. A student prepared for a rhythmic change with much tacit FERMATA.

Ex.1

$\text{♩} = 208$

13	5	7	13	2	5	7	7	13
8	4	8	8	4	4	8	8	8

(Hanspeter Kyburtz "Noesis" 3mvt. bar.161-169)

COLNOT and BOULEZ taught that once rhythmic counting stops in rapid movement, it is impossible to recover, to avoid the inaccuracy in tempo, and corrected in the practical, precise division of the count as follows.

13/8, 5/4, 7/8, 13/8, 2/4, 5/4, 7/8,
 $\Delta\Delta\Delta\Pi\Pi, \Pi\Pi\Pi\Pi\Pi, \Pi\Pi\Delta, \Delta\Delta\Delta\Pi\Pi, \Pi\Pi, \Pi\Pi\Pi\Pi\Pi, \Pi\Pi\Delta,$

7/8, 13/8
 $\Pi\Pi\Delta, \Delta\Delta\Delta\Pi\Pi$

All these are quite basic, but still the most important elements for the ensemble making of contemporary music.

BOULEZ Academy's lessons are historically important. And here, also, to any small and trifle mistake of students, Pierre BOULEZ took care of them in every details. This fact moves all the participants most deeply. And still, it is very missing that the limited time and precious occasion are consumed mainly in basic pedagogical corrections.

Thus, we would like to illuminate the musical, physiological, physical and cognitive basis of BOULEZ's method, point out the fundamental advantage of them in the following sections.

2 NEURAL SOMATISATION OF THE CENTRAL COTEX:

Physiological Advantages of BOULEZ's conducting

2-1 SOMATISATION of music

The physical motions of a conductor contain awful variety of musical gesture. However, they are eliminated within sets of professional actions. Generally, in physical skills, the more one is proficient in the skill, the less one pays special conscious attention to the motion itself: physical action turns "TRANSPARENT" from the view point of the performers' SUBJECTIVE MIND, and thus the brain neural cognitive resources could be available for deeper and advanced music making.

Taking the illustration from musical example, the motion itself goes quasi-automatic through the process of practice, and the subjective consciousness can concentrate to solfage, ensemble and higher levels of music making. Much of the corporeal techniques of music are ruled by autonomic nerve, and automatic system of the human physiology based on human anatomy. This is called as **SOMATISATION**.

Such anatomical and physiological background of performance is, usually, not consciously sensed by musicians during the rehearsal and performance. This fact could be also potential reason of physical trouble of musicians. The **SOMATIC REALITY** of performance is, usually much **DIFFERENT** from **SUBJECTIVE IMPRESSION** of the performers themselves. Some musician break their body and lose his condition because of somatic abuse, where musicians like Pierre BOULEZ can perform perfectly up to his or her 60's, 70's 80's and even higher age.



Fig.1 Pierre BOULEZ teaching conducting techniques at Lucerne Festival BOULEZ Academy 2004.

Fig.. 1 shows the conducting posture of Pierre BOULEZ. Shown in this picture, in the process of conducting, BOULEZ's **UPPER ARMS** scarcely raised **HIGHER** than the level of **SHOULDER** with significant motion of shoulder blade= "scapula".

Exceptional cases are like that to send clear sign to percussion or chorus after long pose: the motion of "scapula" in raised condition would show little tempo, rhythm and musical sign with accuracy (Muscle Group F).

In the conducting gesture by Pierre BOULEZ, upper arm and forearm are mainly used to show rhythm and tempo. The most frequently used part is forearm and is controlled

with muscle group A illustrated in Fig.. 2. These muscles originally control WRIST: they flex and extend, crook and stretch the wrist joint with MANY NERVE FIBERS so that the gentle, accurate and musical motion of forearm, not only the wrist, is possible for the use of conducting.

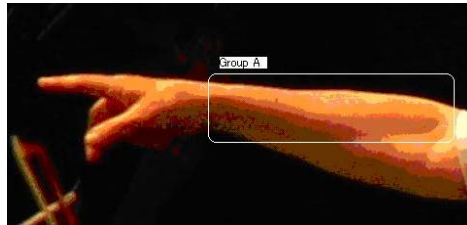


Fig..2 "Muscle group A". The use of these muscles is widely known in various traditions of conducting.

2-2 The sensory=motor system of conducting: case of FOREARM.

In general, motions for conducting could be divided into **5+1** groups.

For the indication of main tempi, these below three **A B C** are dominant.

A: "Flexion-Extension" motion of elbow

B: "Rotation" of "the head of upper arm bone" = "humerus head " at shoulder joint (with less motion of humerus' center of mass)

C: "Flexion-Extension" of wrist

For more detailed expression of musical gesture, these below two **D E** are most frequently used.

D: "Rotation of wrist" caused by X shape crossing of radial bone = "Radius" and ulnar bone = "Ulna"

E: Flexible motions of palm and fingers

Here we can add the “exceptional case” of the shoulder motion and thus we can cover all the anatomically possible motion of shoulder, arms and hands.

F: Motions of shoulder joint with scapula

These muscles, bones and joints, are controlled with nerve system as follows. For the controlling of upper limbs, median nerve, radial nerve and ulnar nerve are most dominant. About the upper arm and around the shoulder joint, musculocutaneous nerve plays important role.

Quite broadly speaking, median nerve system rules the motion of upper arm and radial nerve system rules motions OUTER motion and ulnar nerve INNER motion of the arm, palm fingers.

For the realistic performance, not only conducting but also in piano, violin, wind instruments or any others, the independence and adequate use of these three dominant nerve system realizes musical structure of polyphony effectively.

The muscle group A in Fig..2 is used for the well known “motion of beat”. Within the group A contained following muscles.

Muscle Group A consist of main three muscles A-1 as follow.

Group A-1

Brachioradialis (radial nerve’s control)

Palmaris longus (median nerve’s control)

Anconeus (radial nerve’s control)

In addition to those three above, following muscles are joined for the motion of forearm. This joining is very important from neural and cognitive point of view.

Group A-2

- Flexor carpi radialis (median nerve's control)
- Flexor carpi ulnaris (ulnar nerve's control)
- Extensor carpi radialis longus (radial nerve's control)
- Extensor carpi radialis brevis (radial nerve's control)
- Extensor carpi ulnaris (radial nerve's control)

The surface anatomy of muscle group A is like Fig..3

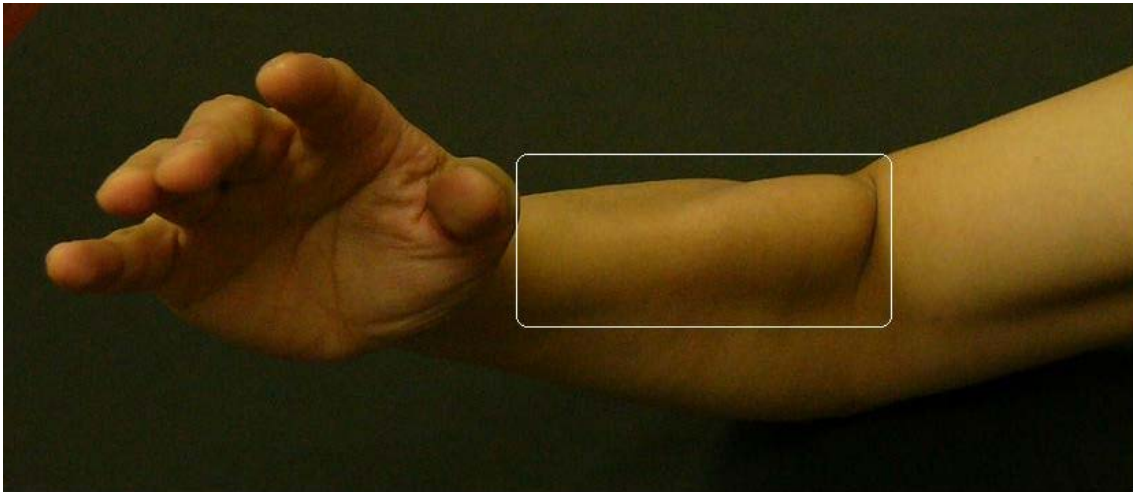


Fig..3 Surface anatomy of muscle group A “muscles for beating”.

With the integrated use of muscle group A-1 and A-2 (esp, Flexor carpi ulnaris), all three dominant neural systems of median nerve, radial nerve and ulnar nerve are utilized into the simple motion of “Beating”[*2].

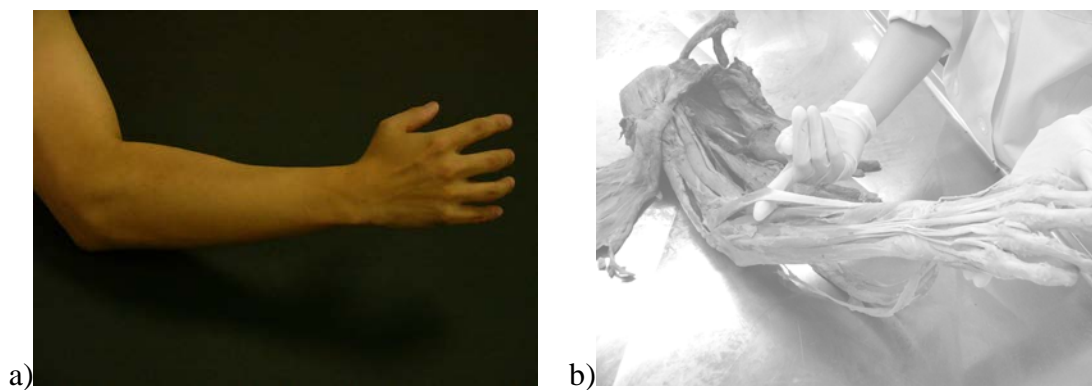


Fig.4 a) Surface anatomy and b) operational anatomical observation for Group A: “Brachioradialis”. With the courtesy of Prof.

WATARAI M.D Department of Orthopedics, University of Tokyo.

For the ordinal motion of flexion and extend of elbow, in addition to muscles group A-1 (Brachioradialis, Palmaris longus), following muscles are used and they mainly supply power, with long motion time constant: they are not suitable for the quick and accurate expression of music at all.

Group A-3 (Group C)

Biceps brachii (masculocutaneous nerve's control)

Brachialis (masculocutaneous nerve's and radial nerve's control)

Triceps brachii (radial nerve's control)

Just mentioned above, these controlling of muscles by peripheral nerve systems parallels to the control of central nerve system, i.e. cerebral cortex. In the following part we will see the neural physiological background and rational effectiveness of the conducting technique by BOULEZ from stand points of BRAIN ACTIVATION.

2-2 Efficacious use of cerebral cortex and utilization of nerve resources.

Fig.. 5 shows the classical PENFIELD's human brain mapping of motor cortex.

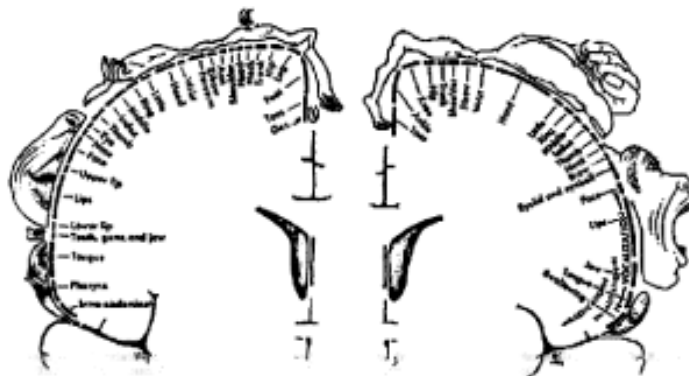


Fig..5 Classical brain mapping of motor-cortex, from PENFIELD [*3]

In this mapping, the area of motor cortex which controls the motion of wrist is as large as or even larger than that of the whole upper arm and forearm, and that of the whole of palm and finger is much larger than that of the arm (Fig. 6).

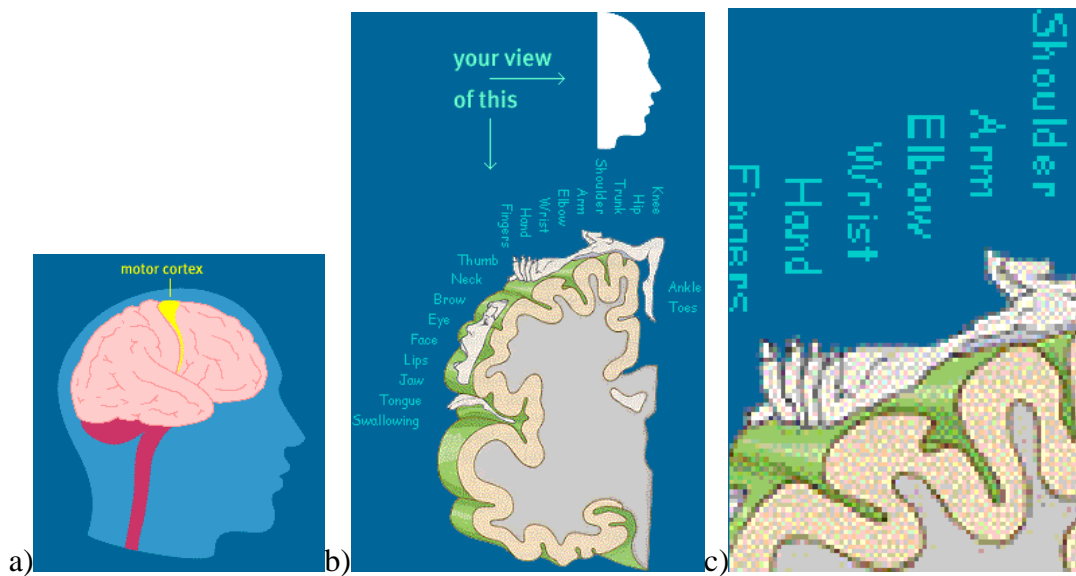


Fig..6 a)b)c) Motor cortex of human brain: control of arm and hand.[*4]

In order to visualize such activation and use of central nerve system, **OPTICAL TOPOGRAPHY** (Fig.7) is useful. It can detect the oxidization of hemoglobin within the blood of brain circulation and can visualize the **ACTIVATION** of the cortex in ordinal **LIVING CONDITION**; an musician's interior brain condition during the real musical performance can be visualized. Fig.. 8 clearly shows the affirmative conclusion to our hypothesis of muscle group A and the advantage of BOULEZ method.

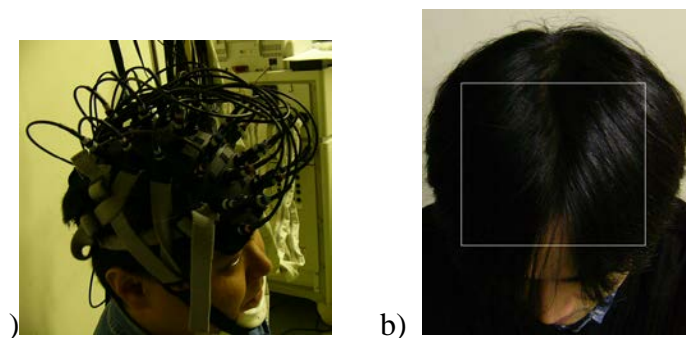


Fig.. 7 a) LASER optical topographical brain imaging: the measurement can be performed in the living condition of the object person, i.e. the interior brain condition during the performance=conducting is measurable. b) shows the area of measurement of Fig..8's case.

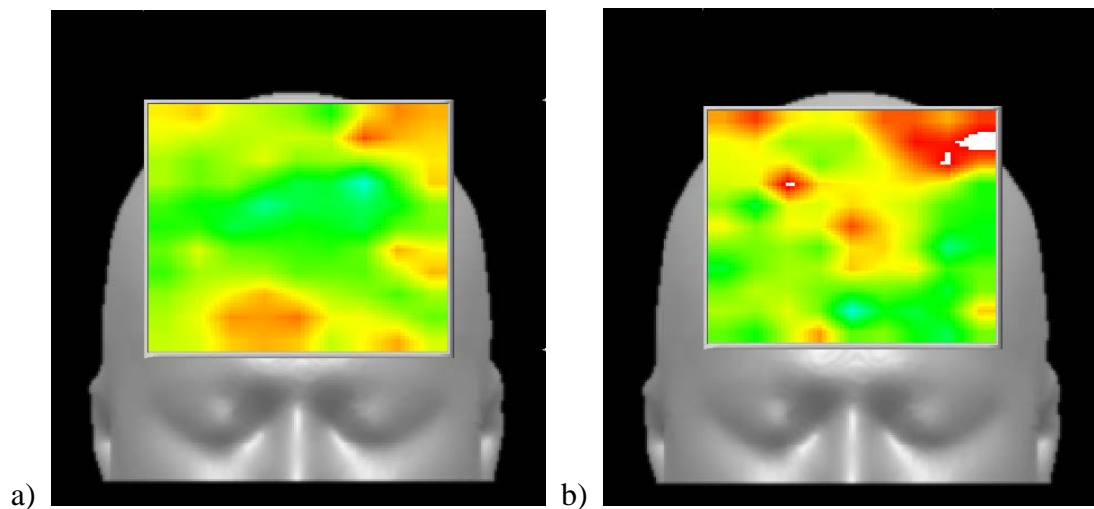


Fig.8 shows the LASER optical-topographic brain imaging view of activation during the conducting of “MIRACLE MANDARIN” by Bela BARTOK ([71] *VSimple vivace*) mainly by upper arm without muscle group A, and b) with muscle group A. The latter clearly shows the use of muscle group A activates broader area of motor cortex. We can conclude that the conducting method of BOULEZ is rational and musical from the view point of brain physiology. In the case of a) frontal lobe is activated and the reason could be guessed as the compensation of disuse in muscle group A.

Thus, we would like to define such installing of music within the central nerve system of human as **NEURAL SOMATISATION of CENTRAL NERVE SYSTEM** in conducting.

At the physical motion of forearm in conducting, the use of muscle group A-2, which originally controls wrist motion are joined to the flexion and extension of elbow in addition to the muscle group A-1 (for power supply) has possibility to double the area of central nerve system on the motor cortex. The mobilization of more cortex would prepare excellent and advanced condition of musical expression. The whole of muscle group A is controlled by three different nerve systems and the forearm can be controlled by different ways. Thus, seemingly almost the same motion of arm could be realized by use of several different nerve networks according to the polyphonic aim. The limited cerebral neural resource should be fully utilized during performance. Just illustrated in the following sections, Pierre BOULEZ’s conducting method contains the adequate use of different nerve systems in the due course of music based on the most careful reading of the score and accurate realization of the genuine form of the piece.

2-3 Motions at shoulder joint

The motions of upper arm within the conducting are basically only ROTATION of humerus head. This simple fact is rarely noticed by musician

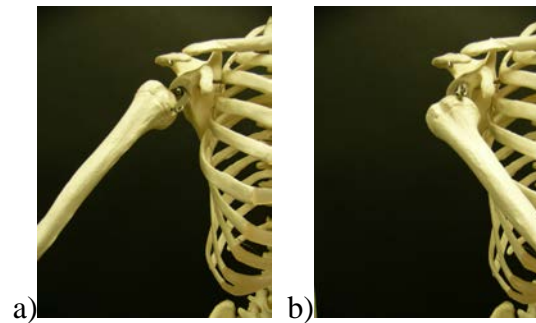


Fig..9 Rotation of humerus head.

Just shown in Fig.1, within the conducting method of BOULEZ the upper arm rarely raised with scapula. The same situation could be explained that elbows are never raised higher than shoulder's level: the center-of-mass of upper arm is stabilized under the shoulder joint and thus accurate rotation = oscillation of humerus is realized in BOULEZ's method.

The muscles concerning to the shoulder motion are as follows;

Muscle Group B

Supraspinatus (Suprascapular nerve's control)

Infraspinatus (suprascapular nerve's control)

Teres minor (Posterior branch of axillary nerve's control)

Teres major (Lower subscapular nerve's control)

Coracobrachialis (Muscuorcutaneous nerve's control)

The muscles which raise elbow higher than shoulder's level are as follows.

These are used only on limited occasions just as already described.

Muscle Group F

Deltoideus (Axillary nerve's control)

Subscapularis (Upper subscapular nerve's and Lower subscapular nerve's control)

Neural physiologically, those muscles are not suitable for the accurate musical control. Moreover, the motion of these part of limb is not clearly recognized by players' peripheral vision during the performance. It is worth while mentioning that in the control of these muscles, median nerve plays little part. These muscles are also combined to the upper arm in natural condition of body, and the role of them is not actively one but to give elastic condition to the physical motion of arm as pendulum with proper characteristic frequency condition. To give suitable inertial momentum and centrifugal force to the dynamical system of conducting body, these muscles play important part.

In various performing arts, relaxing of shoulder is very important . This phenomenological feature involves many potential troubles , and here again one can point out the relationship to the human brain mapping of sensory-motor system.

The motor cortex area which controls shoulder round joint is thought not to be more than that of one finger, and consequently not suitable for the detailed musical expression and accurate control [see Fig. 8 a) and b)].

In the conducting of Pierre BOULEZ, gravity and physical inertia are fully utilized. Motions produced by muscle are minimally used and the motion of gesture get acquired the PHYSICAL accuracy in autonomic ways,

From scapula also stretches serratus anterior. Serratus anterior would work as respiration muscle. This fact shows many important relationships between motion of arm and breath. About this we will provide another report. In many pedagogical system of conducting, the importance of musical respiration is pointed out. Pierre BOULEZ

also do not deny the meaning of musical breath, however his respiration is rather free from single course of music during the performance and this is quite advantageous for the conducting of quite complex structure of polyphony. Even in rapid changes of rhythms from “The rite of spring” by STRAVINSKY to “Le marteau sans maitre”, everything goes with the simplest way without any unnecessary toil.

Another reason for this is NOT to control only the SURFACE of music and body but to control the physical condition, inertia and other state directly according to the deepest request of the CORE of music. This enables us following;

1 To SAVE useless NEURAL TASKS for conductor’s nerve system and

2 To enable to UTILIZE conductor’s SONATIC RESOUECES for musical aims

The purpose of conducting is to give players **PERIPHERAL VISION** necessary signs of music, tempi, phrase, articulation and other information NOT BY SOUND BUT BY silent **GESTURE**, and simultaneously **LISTEN** what is happening during the course of rehearsal and performance and lead all of them for the musical end. For this, needless consumption of any energy by a conductor would be noise to music and ineffective use of the mind of conductor would lose the original point of conducting. Fig..8 shows the importance of relaxing in shoulder and a bad example of stress in shoulder

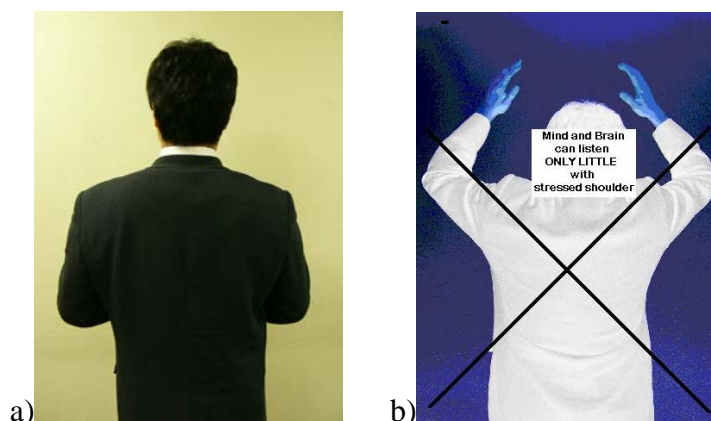


Fig.. 11 a) Relaxed shoulder and b) Over-raised stressed shoulder with scapula’s motion. The latter causes inaccurate gesture and bad listening.

The importance of relaxing would be discussed at the following section over the discussion of physical models.

Motions at the shoulder joint are used usually in slow tempi and expression of legato. And here again we should emphasize that these are mainly caused by the “ROTATION of humerus head”. These could be understood as three dimensional oscillation or non linear limit cycle motion of quasi-rigid body. Shoulder motion is suitable for long-term = slow motion with legato = not distinctive character of music; it lacks in accuracy in rapidity and accuracy in detail.

2-4 The motion of wrist.

Flexion at wrist is suitable to indicate rapid rhythms or fine division of a beat, where elbow flexion is to moderate ones and shoulder pendulum for slow tempi. A generalized model would be discussed in section 3.

The muscles for the motion of wrist are already explained at subsection 2-1. Also the neural physiological advantage of it is clearly shown there.

The largest difference between motions in elbow and wrist is binding condition of kinetics: mass and momentum. “Hand sword” is light and speedy carry out the fast musical aims.

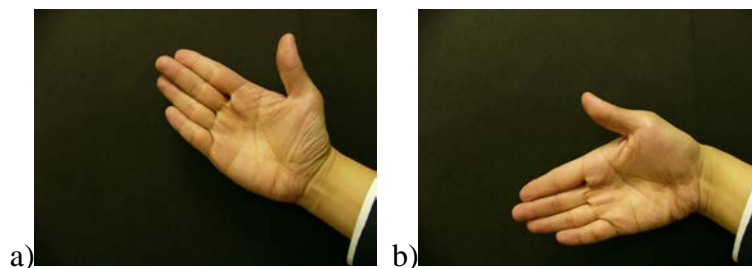


Fig.. 9. “Hand sword” a) expansion an b) flexion pendulum at wrist.

2-5 “Rotation at wrist joint”: Spin-snapping by X shape crossing at radial-ulnar bone and joint system.

Up to subsection 2-3 concerned indications mainly for tempi, rhythm and basic elements of music in conducting. From this subsection, muscle group D and E is combined for more delicate feature of music: they are not so suitable for peripheral vision of players, for the muscle and part of hand is not so large and the action could be overseen; in other word, these would be used for detailed expression without breaking the large scale flow of music and transmit necessary information for adequate parts of musicians.

Motion of hand and fingers are suitable for phrasing, nuance details of music. As is widely known, Pierre BOULEZ do not use conducting button. With this apparent fact, in his method, hand and fingers have much possibility of freedom, regardless to the restriction to handle the button.

As we saw in the brain mapping, the cortex which rules wrist, palm and finger is much larger than that of shoulder, it is very important how to use these neural resource during the performance, in either cases a conductor uses a button, or not.

BOULEZ compared the disuse of button like loosing tails in the course of evolution process from ape to human. From cerebral point of view, this suggests much for musicians, misuse of instrument would bound musicians in nonmusical situation and BOULEZ emancipated himself from the restrain of button, and got the freedom of full utilization in wide brain cortex area. This could be called as“ an evolution of conducting method”.

Cerebral basal metabolism is supported by glucose, grape sugar transported by blood flux. The careful and musical use of hand and finger, which are networked to wider central cortex, would make activated cerebral circulation and keep the high level of

consciousness and attention during the performance. BOULEZ's method would be supported from this brain - metabolism's point of view.

“The ROTATION of WRIST” is basically not “Rotation in wrist joint” but spinning of forearm containing the whole of wrist and palm”, and this is caused by the X shape crossing of radial bone and ulnar bone.

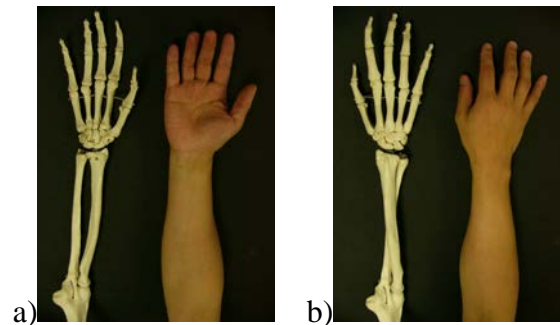


Fig.. 10 “Rotation of wrist: SPIN – Snapping by X-shape crossing of radial bone and ulnar bone-and-joint system a) and b)

For this snap of Spinning motion, much of muscle group A-1 is “involved”. The basic control of this is supported by following muscle group D.

Muscle Group D

Pronator quadratus (median nerve's control)

Supinator (radial nerve's control)

Here, Pronator quadratus is ruled by median nerve and ulnar nerve, and Supinator by radial nerve. The independence of both nerve signal-transmitting routes plays important role not only in conducting but all the Musical performance and skillful artwork.

Inward motion of rotating-spinning would be coordinated and smoothly combined by median nerve, and in the necessity of SUBITO PIANO or rapid is physiologically measurable. Fig.. 11 shows a typical example of such.



Fig.. 11 Indication of rapid pause using ulnar nerve signal transmission.

2-6 Motion of palm and fingers.

Just shown in the brain mapping, the palm and fingers are networked to the widest area of central nerve system of cerebral cortex, and consequently enables musician the great freedom of musical expression. However, for the case of conductor, it plays little role for EXTERIOR indication, as much as open the hand and close, but for INTERIOR processes of conducting, they are most important.



Fig.. 12 Open-and-close freedom of the palm-finger is related to wide area of cortex.

The muscles related to these are as follows, such a long list of precise peripheral system.

Muscle Group E-1: Muscles on the palm side of forearm.

Flexor digitorum superficialis (median nerve's control)

Flexor digitorum profundus (median nerve's and ulnar nerve's control)

Flexor pollicis longus (radial nerve's control)

Note that all the three dominant nerves system are concerned to E-1.

Group E-2: Muscles on the backside of forearm

Extensor digitorum (radial nerve's control)

Abductor pollicis longus (radial nerve's control)

Extensor pollicis brevis (radial nerve's control)

Extensor pollicis longus (radial nerve's control)

Extensor indicis (radial nerve's control)

Note that Group E-2 muscles are mainly ruled by radial nerve system.

Group E-3: hand muscles

Abductor pollicis brevis (median nerve's control)

Opponens pollicis (median nerve's control)

Flexor pollicis brevis (median nerve's and ulnar nerve's control)

Adductor pollicis (ulnar nerve's control)

Palmaris brevis (ulnar nerve's control)

Abductor digiti minimi (ulnar nerve's control)

Flexor digiti minimi brevis (ulnar nerve's control)

Opponens digiti minimi (ulnar nerve's control)

Lumbricales (median nerve's and ulnar nerve's control)

Interossei dorsales (ulnar nerve's control)

Interossei palmales (ulnar nerve's control)

Note that Group E-3 muscles are mainly ruled by ulnar nerve and partly

By median nerve; radial nerve system plays little role here.

The Group A, B, C, D, E and F covers all the main muscles in the human limb and we had identify which muscle is controlled by which nerve system within the dominant three controls it. In good, physiological and music coordination to the posture, breathing = respiration muscles and nerve system, desirable technique of conducting would be realized and, no doubt, the method of Pierre BOULEZ embodies the whole. There are several most important parameter like fluctuation at the center-of-mass of whole body, and we would discuss them in separated article intensively. In following sections of this paper we would like to concentrate the simplest physical analysis.

3 PERIPHERAL SOMATISATION:

Kinetic models for physical conducting gesture

Just emphasized in this article, the principal end of musical conducting is to give necessary musical information = cues to the **PERIPHERAL VISION** of players in correct time sequence.

Hence, accuracy of gesture by conductor is necessary but it is not sufficient. In case if cues are not received = accepted, all the gesture of conductor would make no sense and it would turn into a kind of dancing. Cues by conductor must be “measured” by the observers = players in right timing.

Thus, the importance of **EXPECTABILITY** in conducting gesture, the possibility for musical anticipation by players rise up clearly.

Cyclic motion of physical object is “**PREDICTABLE**”: pendulums of mechanical clocks or physical metronomes are typical examples of such case.

The reason is that the binding conditions of their kinetic system are stabilized and observers easily recognize the periodical nature of the motion and trajectory.

In realistic techniques of musical conducting, all the cues, even including the “subito” changes of whole musical atmosphere should have write and correct **EXPECTABILITY** shared by all the members of the ensemble reflectively: i.e. without long discussion of specific coding of signs.

Therefore, kinetic autonomous stability would play most important role for this aim: with natural and physiological nature of human vision for motion perception, peripheral vision can safely catch the quasi-periodic limit cycle motion of conducting and all the

players can share common timeline of musical tense: here most of the players' central visions are focused on performing materials or other necessary objects..

Certain kind of conductors' "SPONTANEOUS" or "arbitrary" "willing" motion have THE LEAST EXPECTABILITY and sometimes break the ensemble proceeding of music.

In last section, we saw the advantages of Pierre BOULEZ's conducting techniques which utilize the kinetic motion in gravity field, from the standpoint of conductors' cerebral cognition, and now we shall add that the same technique and method have much advantage in consequence of players' cognition during the performance.

Real bodies of individual conductors are quite different from person to person and it would be no use, neither to oversimplify the conducting motions into specific patterns, nor to compute too much complicated numerical models, for realistic musical purpose. In this paper we focus only on the anatomical, physiological and physical characteristics of human nature in order to keep the applicability for wide spectra of concrete musical situation.

The simplest physical models would provide useful viewpoint for musicians to realize "natural" and "non-artificial" (although all the musical performance is artifact, indeed) ;conducting gesture "without unnecessary intentions".

For the driving force of the motion = gesture, not only power fed by muscles, gravity but also elastic tensions and other centrifugal forces built in the human body should be fully utilized for ideal motion of conducting.

Kinetic condition of a conductor's body, i.e. kinds of inertia momenta and other characteristic values, determines the "EIGENVALUE" of gesture, and the art of conducting is not to perspire against music and unnatural body condition but respire the correct musical tense and drive = control the corporeal situation with minimum energy loss and realize the maximum of musical outcome. In physical

metronome, the position of weight fix the “**EIGENVALUE**” i.e. characteristic frequency of the pendulum, and in living conductors’ case, physical conditions of body should be changed autonomously and “indifferent” gesture could be realized. It simultaneously makes the conductors’ listening in clear condition.

Here, what is most important is not the “periodical” “constant” part of the motion but **CHANGES** of them, like sliding weight of metronome from one position to another. The **EXPECTABILITY** of those **CHANGES** must be indicated **QUASI AUTOMATICALLY** to the peripheral vision of the players, and for this aim, speculation by use of linear and non-linear kinetic model of human body is quite useful. Thus, we would like to define such kinetic and physical condition of gesture as **PERIPHERAL SOMATISATION OF CONDUCTING**.

3-1 Ideal harmonic oscillator’s kinetics in gravity field.

In the researches of Robotics and human technology, modeling of human action as jointed system of rigid body is frequently used [*5]. Neglecting the interior structure of organs, such models would give simple view for the use of science and technology, and development in the field like 2 legs walking robots are significantly made progress from the beginning of this century.

One of the simplest case of such rigid body system is multiple rigid pendulum. Following illustrates 2-dimensional multiple rigid pendulum [*6]. The merit of such model is to understand the kinetics of the gesture and action. Simultaneously we must point out that the limitation of such model is that they can neither create nor promote the music making and evolutionary progress of music itself toward the future.

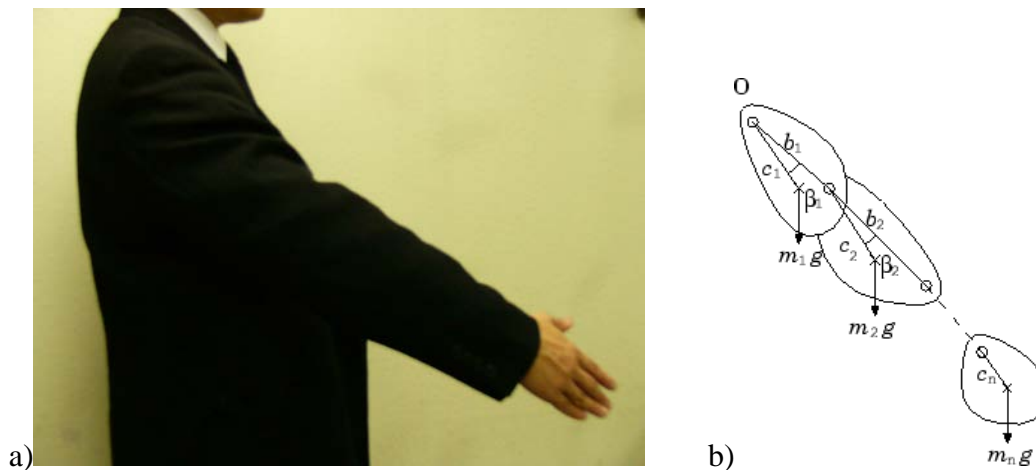


Fig..13 a) Human posture and b) multiple rigid body pendulum model for conducting.

These models and their equation of motion can be solved with personal computer. Non-linear dynamical analysis of such motion is intensively pursued. It is widely known that the multiple rigid body pendula have non-linear-chaotic characteristics.

Researches to understand human actions as mathematical chaotic system are also widely promoted in the field of action science and the results of such trials would contribute to music making in the near future. However, from the standpoint of performance, we should start from much simpler case.

In musical conducting, broadly, tempi in between 40 M.M. and 208 M.M. would be indicated by corporeal action; the musical metronomes would feed those tempi above.

The range of tempi also covers the heart ratio of human heart, from fast sleeping up to the fastest dashing. Usual situation of musical performance is under the normal condition of gravity on the earth.

Thus we can think of the simplest case as ideal harmonic oscillator pendulum with the frequency mentioned above,

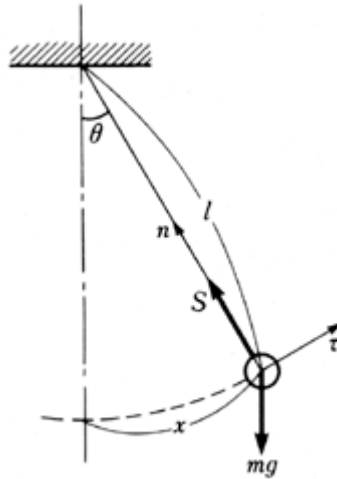


Fig..14 Ideal gravity harmonic oscillator: the simplest analogue of kinetic model.

From the center of mass at the weight, let the arm's direction of the pendulum n axis and velocity's direction τ , l as the length of the arm, θ as oscillating angle, m as mass of the weight, g as gravity acceleration and S as the tension on the arm. We assume the simplest case, 2 dimensional motion and the friction of the air is neglected.

Such ideal 2-dimensional gravity pendulum's period T (sec.) is given in following form;

$$T = 2\pi\sqrt{\frac{l}{g}}$$

In this ideal harmonic oscillator T is **determined only by l , regardless of m .**

The metronome tempi M.M. would be given by the inverse of $T/2$ multiplied 60 times. Thus, we can define IDEAL CHARACTERISTICS LENGTH of motion according to the metronome tempi. From musical point of view, we can understand them as characteristic length combined to "*tempo giusto e ppp*"

M.M.	42	60	72	108	144	180	208
l (cm)	202	100	69.2	30.8	17.6	11.2	8.2

For the convenience of comparison, we assume typical length of human limbs, arms and hands like the case of the Swiss architect Le CORBUSIER’s concept of “**MODULOR**”(Fig.15)

Palm(close-open)	Palm-forearm	Limb flexed	Limb stretched
10-25 cm	30-40 cm	30-60 cm	60-80 cm

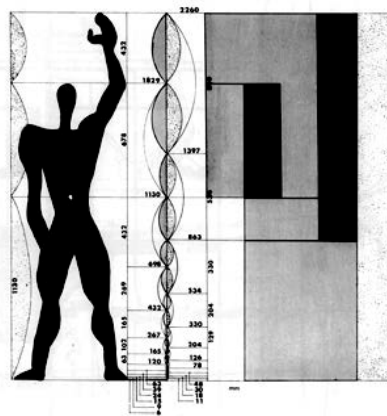


Fig..15 Cf. Le Corbusier’s Modulor

We immediately know from the table above that the characteristic length of ideal smallest harmonic oscillation of 60 M.M. (100cm) or 42 M.M. (202cm) are too long for the physical scale of human limbs, from *allegro* to *vivace* the use of limbs with the use of gravity would be effective and most rapid tempi such as 180 M.M. or 200 M.M. the additional use of other elastic principle for conducting would help the accurate gesture. For the realization of “musical” *andante*’s, *largo*’s or *grave*’s gesture, we should add the “realistic” element of weight, characteristics of rigid body, or even elasticity of muscle, bone and joint for the “ideal” mass-less harmonic oscillator.

Most of the beginner conductors failed to realize musical expression with too much useless, over-consciously stressed motion unwillingly. The concept of peripheral somatisation is to intend for the removal of useless stress from nerves and muscles and embodies the essentials of music for the performer.

3-2 Indications by the combinatory use of different oscillators

In this section we would like to consider real corporeal configuration with simple kinetic models. Gravity oscillators would be divided in to two groups' one is inverted pendulum and the other is ordinal suspended pendulum (Fig..16). Most of forearm's [Fig.. 16- a)], hand's and palm's [b)] movement should be understood as inverted pendulum with binding condition, where the oscillating movement of whole limb at the shoulder joint should be understood as suspended pendulum [c),d)]. Note that the case of limb's periodic motion with flexed elbow [d)] is often misunderstood. θ gives the angle from vertical direction and to deal with the efficient length as gravity pendulum we should multiply cosine of θ , in most case the value is wound $1/\sqrt{2}$ as projection coefficient, but as long as think of these qualitatively this correction is not so significant.

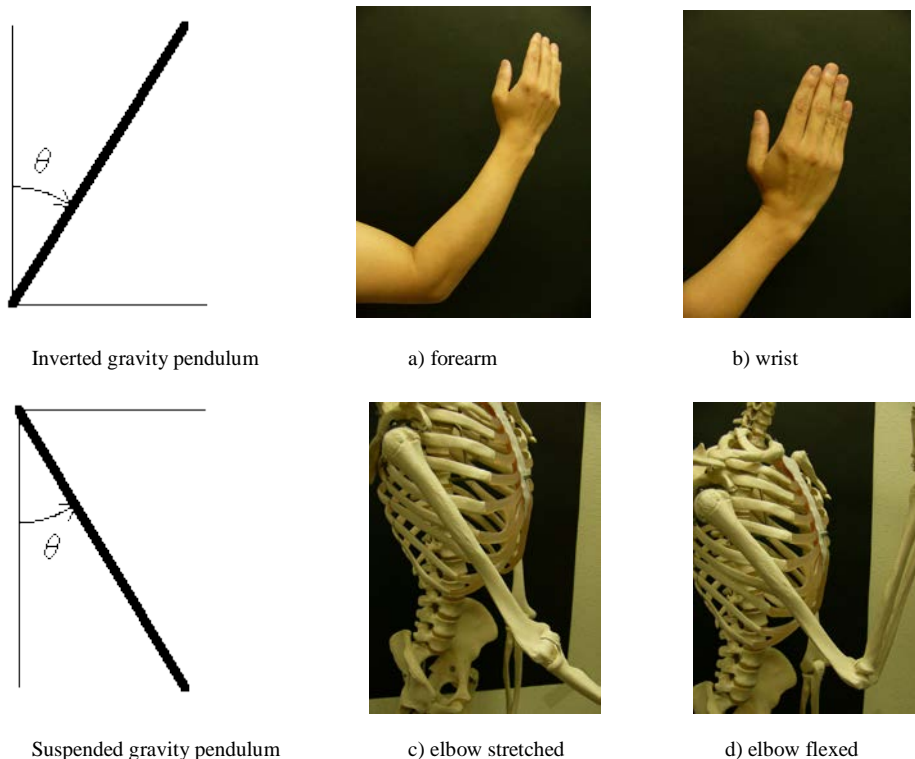


Fig..16 Modeling of conducting gesture as gravity pendula

The motion of forearm could be switch from suspended pendulum to inverted, and inverted to suspended according to the binding condition. Such switching within

corporeal system is the most important part of practical peripheral somatisation for conducting, for these switch of kinetic characteristics of body enable accurate division of a beat, change of basic beat, polyrhythm, isorhythm and sudden stop in musical context.

Kinetic nature or elastic condition of body can easily changed as somatic condition, a conductor can utilize the non-linear feature of rigid body pendulum or crooked centrifugal force of arm and can easily realize kinetically rational trajectory at three-dimensional space in right time sequence.

Pierre BOULEZ fully utilizes these kinetic principles in his technique and realizes necessary gesture without any arbitrariness.

Up to here we have thought over the ideal cases of subtle motion, and for general musical situation we can apply the non-linearity or elastic nature of body in the realistic music making and conducting.

Just mentioned above, the advantage of these would be clear at concrete situation of dividing a beat, change of rhythm and sudden stopping, and I would like to show these respectively.

3-3 Division of basic beat

In Pierre BOULEZ's conducting, the DIVISION of basic beat is realized by use of different joint MORE PERIPHERAL from the center of body.

If basic beat is indicated by use of shoulder joint, elbow would be for the division, and also wrist would be available. If the elbow gives the basic, division would be by wrist. Most apparent case of this is not the division but very fast passages superposed occasionally into the basic flow of music in "IMPROVISATION SUR MALLARME",

and the same physiological - anatomical principle would work for general application of division. The division of basic beat could be divided into two groups:

1 Equivalent division

2 Inequivalent division

In both cases, preparation for the division is necessary before half period of the starting of division; indeed, from the timing of this preparation, elastic condition must be shifted to the next one so that players can safely expect the division at their peripheral vision and the whole ensemble goes musically.

At the very moment of utterance, ensemble must know the shared accurate timing of division and for the realization of expectable gestures, somatic preparation must precede to the musical tense. Thus, we may say that the realization of correct, expectable somatisation is the most important for this.

3-4 About the change of basic beat and pause

The change of rhythm should also prepared within the somatic condition of conductor precedent to the utterance. We would like to think of the simplest case of changing basic beat as following example.

$$\begin{array}{cc} \mathbf{3} & \mathbf{2} \\ \mathbf{16} & \mathbf{8} \\ \Delta & \Pi \Pi \end{array}$$

In this case, the basic beat of former bar is $3/16 (= \Delta)$ and the latter $1/8 = 2/16 (= \Pi)$ and the duration of basic beat is 1.5 times extended. In the technique of BOULEZ, $3/16$ is indicated with an elegant motion at shoulder joint and $1/8$ at concise chopping at elbow joint.

We apply the simplest kinetic model here. Thinking only with the length of the arm, the limb is almost 2 times as long as that of forearm and even if in the case of ideal pendulum the period is as $\sqrt{2}$ times long; it means the kinetic characteristic time is almost 1.41 – 1.5 times long even the case of ideal pendulum, and for the realistic limb and arm, it is quite easy and with the minimum energy loss in any meaning to realize the motion.

Just as we can know from the pioneering works by BARTOK, east European folk music has good tradition of such rhythm, and simple analysis with such calculation suggests possible origin of such folk tradition from corporeal condition. The speculation about limb and forearm is also applicable for foot and shin, and from anthropological point of view, we can discuss interesting theme of human somatisation of music in wide spectra of history, region, tradition and civilization.

A particular example of non-linearity of motion often emerges in every music is PAUSE. A non-linear limit cycle motion most of which consist of posing would be also useful for the preparation of musical stopping. For more detailed gesture, every kind of changes in SUBITO including pauses are possible, especially with efficient use of different peripheral nerve systems. With the deliberation in former section 2, we can combine nerve-muscle system in different peripheral controlling system and construct physiologically rational movement of conducting gesture, and with the somatisation of such we can realize musically desirable cues for sudden pausing < ’ >.

After the INWARD FLEXION of limb and forearm, EXTENSTION of wrist, palm and finger would give (seemingly contradicting but musically excellent) “smooth” “expectable” “sudden” gesture for pausing [Fig..17-a)].



Fig..17- a)

After the OUTWARD EXTENSION of limb and forearm, FLEXTION of wrist, palm and finger would give the motion. [Fig..17-b)]



Fig..17- b)

As we have examined, the motion inward is ruled by median and ulnar nerve system and motion outward by radial nerve system.

In former case, <the preparation - motion of limb: median and ulnar system> and <the preparation –motion of hand: radial system> would work simultaneously and quasi-independently, and there is no needless time rag which emerge in case of the same nerve system's usage UNARBITRARILLY.

Such time delay could be as long as -100 msec and is audible musically. Unwilling neural pulse delay for music must be avoided, and thus it is important to know such background of peripheral somatisation, which is usually not noticed by musicians, for the musicians themselves.

On the centrally, in case if one would not like to show distinctive “POINT” for the pausing, using the same nerve system would give the opposite result and all the players within ensemble can share the controlled uncertain ambiguity. Inward flexion of hand

following the flexion of limb would make gentle and moderate shift for pausing Fig..
[18-a)–b)]

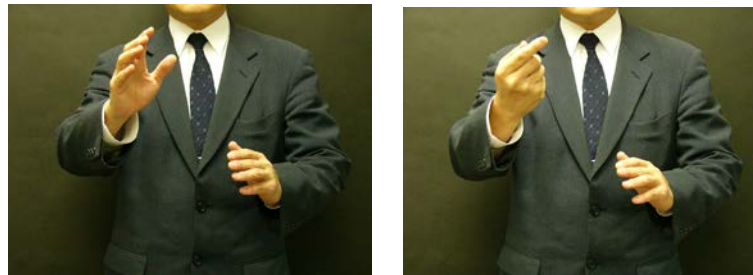


Fig..18- a) – b)

and vice versa [18-c)–d)]

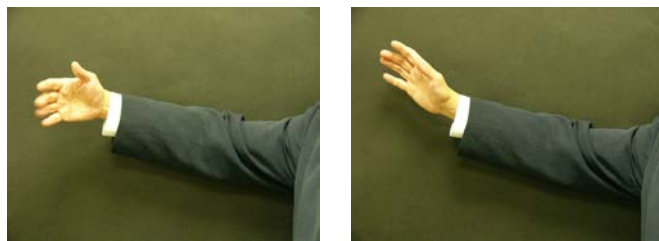


Fig..18- c) – d)

Here we can not but think of the “espace-temp lisse” by BOULEZ and the musical realization of this, and at the conducting of his own composition, we can realize the somatic control of Pierre BOULEZ is in complete accordance with the musical thinking.

After such deliberation, not eliminated in conducting technique, for all the music making processes in detail, the distributed use of nerve system = good somatisation of music turned to be quite significant and fundamental. And the approaches by BOULEZ showed the importance throughout the music thinking of composition and conducting.

In the logical structure of physics, such detailed nature WITH and WITHOUT distinction, i.e. <avec strie> and <sans strie = lisse> by BOULEZ [*7], is described with **QUANTUM NUMBER**. Certain observable would be quantized and some

remained within smooth continuity of uncertainty. Thus, we can develop a new kind of well-organized music thinking both for performance and composition with quantum numbers and its orderings, i.e. **SERIES** in its extended meaning over the 50 years' progress, accumulation of knowledge and wisdom in the latter half of 20th century. We can define various kinds of **SCALES** on the basis of **GENOMIC** configuration of **NEURAL-SOMATIC SYSTEM** and can choose adequate action for music fundamentally, following BOULEZ's principal. Secondary Generalized Serial way of music thinking is possible and for conducting, Pierre BOULEZ himself embodies the whole of this by his own.

Here also we can not but remember the remarkable ways of thinking on **SERIES** by Gille DELEUZE and Felix GUATTARI [*8], the contemporary of Pierre BOULEZ himself, and from the prophesies of 20th century, we can seek for **ANOTHER** possibility of music making, both throughout the composition, playing instruments, conducting and other performances beyond the genres.

4 SOMATISATION STRIEE / LISEE;

Voluntary and Soma with / without “pli”

For long years, I have deep interest in the ORIGIN of HUMAN FREE WILL. Especially, concerning to the problem of HAZARD in music, from the stand point of composer=conductor, confronting to the problem of CONSCIOUSNESS and VOLUNTARY seemed to me most fundamental.

Then, after starting intensive works over this problem, we learn to know how much part of human will is autonomous and how small part of it is arbitrary. Most of the “central” parts of human being is just like slave of “periphery”.

With the rapid and significant development of consciousness science after 1970's, and especially from 90's and after the sequence-period of genomics, the problems of nerve system turns literally the MOLECULAR level and the quest, not for the origin of the consciousness, but the fine processes of conscious phenomena gives much suggestion and indication to music making. Fortunately, most of the important preparation was ready by the pioneering contributions by BOULEZ and other important prophets.

In the beginning of 1950's, during the development of early music synthesizer with the technological development during the second world war, BOULEZ and other pioneers like Karlheinz STOCKHAUSEN had examined the human auditory characteristics with the scalar frequency variable and got fundamental observations of human listening. As is widely known, the principle of music synthesizer is the addition of FOURIER components, and from the speculation on it, introducing measures into many various parameters = axes, musical analogues like mathematical spaces or manifolds with “strie”- stripes and without “strie” = “lisse” smooth ones are defined by Pierre BOULEZ [*9].

With such discrete steps of quantization, generalized concept of “series” was invented, and over the music thinking of “total serialism” human beings got the fruit of music including “le marteau sans maître” with the text by René CHAR, and “pli selon pli” with texts by S. MALLARME.

Looking forward from the “Zero Degree” we would find, from one variable frequency model to the spectral extension of music thinking mainly promoted by G. GRISAY and his contemporaries. Thus, after 70’s, the popularization of one-chip computer and the very pioneering contributions by BOULEZ, founding IRCAM, development of 4X, Next system and following innovations, wide spread of digital processing on PC by sound board who has the origin in IRCAM board, enabled the whole progress of auditory brain cognitive science after 1990’s.

With the acceleration of computing speed, digital sampling system and real time processing MIDI instruments system were innovated. This progress parallels works by BOULEZ, from “...explosant/fixe...”, “Repons” up to “Sur incisives” and “Anthemes II”.

The problem of music writing “écriture” and the perception of the musical result must be separately treated. Thus, serial ways of music thinking, which enables us to introduce auditory cognitive steps into musical parameters objectively, would rather play fundamental roles in 21st century after the full digitization of musical and acoustic equipments. With sampling and various sound generating systems, awful amount of possibility is opened in front of music and we have not yet establish general way for it: we must define directions, introduce measures for various scales and think, create and analyze them. We shall call such process as Secondary generalization of serial method.

And just examined in preceding section, neural-cognitive physiology prepares necessary background for this after 1990s. These are not limited only within the problem rhythm, but timbre, speech and singing and every other profound problems [*10].

Now we would like to have a overview along the frequency axis the situation at 2005.

---Table of timescale in music and human neural-cognitive auditory characteristics---

100000 ksec.

A day : 86400sec Physiological circadian rhythm

Half a day : 43200sec.

Long term memory ~LARGE SCALE PIECE
Theater, Cinema OPERA ETC.

10 ksec..

An hour : 3600sec

~A WHOLE MUSICAL PIECE

Television program

1000sec.

~A MUSICAL MOVEMENT

Television/Network video clip

100sec.

Television commercial video clip.

Short term memory ~SECTION OF MUSIC

10sec.

Respiration time length ~A MUSICAL PHRASE

1sec.~1Hz. 60MM

Heart rate 40MM-200MM Ca. ~RHYTHMIC PERCEPTION

Human mind delay time for emergence of intellectual recognition

100msec.~10Hz.

Human mind delay time for emergence of emotion & perception

30Hz. Time resolution of motion vision <INSENSIBLE>

~40Hz. The 40 Hz global brain oscillation (unified sensory-motor synchronization)

~Human Audible Sound

10msec.~100Hz.

~PITCH LISTENING, COGNITION OF TIMBRE

1msec.~1000Hz.

~HUMAN VOICE :VOWEL

10kHz..

Resolution limit of gap in continuous sound ~ HUMAN VOICE (GAP)

~ HUMAN VOICE :

CONSONANT

100kHz.

Limit of Human auditory sense

1MHz (Bit ratio of real-time network communication data transport)

With such a bird's-eye view, we can get a general platform to transfer problems of music to that of brain cognition, and vice versa, i.e. after the middle of 1970's, Francis CRICK turned from molecular biology to begin pioneering contributions to consciousness science. Now we can translate the most fundamental discussion of cognition by CRICK and C. KOCH [*11], A. DAMACIO [*12], R. LLINAS [*13] or P. & P. CHURCHLAND [*14], directly into the central questions of practical music making.

These are not the kind of armchair theories or bookish imaginations, but quite realistic methodology of composition, performance, conducting, special configuration and arrangement of instruments or speakers, for, before those, we human beings have no systematic way of music thinking to deal with such objects.

These also have much to do with the fundamental questions of “music and memory” “music and space perception” “auditory senses and emotion”, and more over, from informational ethics of media agitation in consequence of Fascism, up to mind controlling and brain washing by use of audio-visual media. Just after the resonance of tocsin by ADORNO [*15], we can introduce a throughout viewpoint of the world and experience of space-and-time. For us musicians the work is to find the way to music ON the basis of this new common platform.

From the discussion of “voluntary and hazard”, from performing artists' point of view, we can magnify the interior part of musician and inner principle of musical structure and deepen some of them as problems of “voluntary and soma” in music: somatisation and its perceivability and imperceivability: arbitrariness and non-arbitrariness. The most profound quest to come is to seek for “espace strie” and “espace lisse” in such somatic space = manifold and find / construct new system of music with unknown, uncharted autonomous principle.

Another important point of view for the conducting would be got from problematic of space-time cognition over the opera / theatrical creation.

We immediately remember several cases, from the BAYREUTH “Festspieltheater” of R. WAGNER [*16], its historical problems up to “Cite de la musique”; in connection to these two we think of the speculations by Michel FOUCAULT [*17]. Think of the problem as cognition of real time-space performance, the unified view point has apparent advantage for creations to come.

Now, standing at the “networked” age of early 21st century’s globalization, we can look back the past and can choose future with the most careful eyes and ears. From the point of brain cognition, the emergence of emotion precedes to that of reasonable conscience, and the warning by ADORNO / BLANCHOT has physiological basis on this fact. For the importance of this fact in the networked audio-visual information society, we should prepare for another paper, but hoping to deal with music “performed and rang in the real space and time” we can not but overestimate the contemporary meaning and significance of the tocsin by BLANCHOT=CHAR. And seek for such realization, “fertile lands” prepared by Pierre BOULEZ is one and only starting point for this journey. In this paper we mainly deal with the realistic techniques of conducting, but we can apply the BOULEZ principle for every possible music making and find adequate “secondary generalized serial manner” in each case. We can observe new light of rising sun from the horizon of BOULEZ and execute spectroscopy into stripes and continuous band, arbitrarily and non autonomously, from case to case with the utmost of musicality. Voluntary is not non-dividable unity but a kind of space-manifold into which we can introduce / or not introduce various measures = steps = pleats. We can continue the discussion about arbitrariness / non-arbitrariness with / without “pleats” from various aspects, and over such speculations, can construct musical structure “pli selon pli”.

The quests between voluntary and soma are about to set off. What kind of pleat we can / can not plait is still unknown. The only way to seek for answer seems to me to make music, and cultivate its fertile backgrounds.

5 “Here and Now” to come ... (ICI ET MAINTENANT A VENIR...)

The “structure” and early versions of “marteau” were composed just the same time to the discovery in double helix structure of the gene (DNA) by WATSON and CRICK [*18] : i.e. the start of total serial way of music and molecular biology seemed to me kind of twins in the broadest vision of the history.

After remarkable progresses during the latter half of the twentieth century, the panorama of arts and sciences had seemingly change a lot. However, just like the fact that serious kinds of disease fifty years ago still remains its position after the post sequential era of genome pharmacy, fundamental problems of music still remains in the veil of Muse, like the mystery of life, the origin of human mind and consciousness, and from my view these fundamental questions could be combined each other at the deepest level of the question. On 2005, at the beginning of 21st century, the music thinking of performance and composition stands in front of the quest of genetic origin and controlling of arbitrariness and non-arbitrariness.

The classical PENFIELD’s brain mapping was obtained through the clinical researches during 30’s and 40’s, and formalized at the beginning of 50’s. This time record directly reminds me of that of serial music, middle and late works by WEBERN were written at the same time with the CHAR’s letter, and after 1945, middle MESSIAEN and early BOULEZ, up to the manifestation of T. ADORNO in the famous work “PRISMEN”. Now we are ready to go back once again to the text of BLANCHOT and can find different way to go.

An historical necessity of development in music, music thinking and aesthetic is posed with the background movement of the time. Thinking of these, we shall confront to the pioneering contributions by Karl DAHLHAUS [*19] and Theo HIRSBRUNNER [20*] under different spectra and directions of light.

With the change / progress of the time, science, technology and society, fundamental development of music both in creation, performance is possible on the way beyond the horizon which Pierre BOULEZ had lead all of us to see.

Music is opened to unknown hazard of “ now and here ” and we would continue to seek for different “ now and here to come ”, compose, perform, conduct and make progress of music “ pleat by pleat: pli selon pli ” . □

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About the fundamental importance of auditory illusion, I must send my best thanks for **Goergy LIGETI**, who on one hand evaluated me and on the other hand criticized most bitterly, and gave me the hints for the problem of cognition, on conversations from 1993 in Tokyo.

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The idea to write this paper was got during discussion with **Dr. Theo HIRSBRUNNER** at theatre café in front of Europa Platz Lucerne. The author would like to dedicate this for **Dr.**

HIRSBRUNNER with the deepest respect and the best thanks.

Ken ITO : 1965- Composer=Conductor.

Born in Tokyo and studied composition under Teizo MATSUMURA, Yoritsune MATSUDAIRA, Jo KONDO and Yuji TAKAHASHI. Got many prizes and awards including Tokyo Metropolitan Award judged by Goerlgy LIGETI (1993) and Takemitsu Music Prize by Luciano BERIO (1999). Also conducted historically important performances including the world premier of Yoritsune MATSUDAIRA's "Le Dit de GENJI". He had either commissioned composition from numbers of orchestras, soloists and foundations or invited from the top orchestras and festivals for conducting important concerts and theatrical projects.

He also majored quantum physics of super conductivity at Tokyo University (1986-), and with the suggestion of LIGETI('93) and BOULEZ('95), studied brain cognitive physiology (1995-) and got Ph.D with the Fundamentals of Music :Composition and Conducting based on post genomic cognitive sciences and medicine (1998) and immediately appointed to the Professor of Composition=Conducting / Epistemological Poetics at Tokyo University(1999).



With Pierre BOULEZ, at Lucerne Festival.

CAPTIONS AND REFERENCES

[*1] "Intellectuels en question"(1995) pp.59 A letter by R. CHAR. original : <Je veux n'oublier jamais que l'on m'a contraint a devenir - pour combien de temps? - un monstre de justice et d'intolerance, un simplificateur claquemure, un personnage arctique qui se desinteresse du sort de quiconque ne se ligne pas avec lui pour abattre les chens de l'enfer. Les rafles d'Israelites, les seances de sclap dans les commissariats, les raids terrolistes des polices hitlerriennes sur les villages aburis me soulevent de terre, plaquent sur les gercures de mon visage une gifle e fonte rouge.>(1943)

[*2] In Japanese pedagogic system of conducting in SAITO style, those muscles are known as involuntary muscles, and from physiological point of view it is completely misunderstanding. For the motion of forearm, these muscle groups are not voluntarily available by beginners, but they are originally voluntary muscles for the motion of wrists.

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[*4] From <http://www.pbs.org/wgbh/aso/tryit/brain/mapcortex.html>

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[*8] Deleuze G. Guattari F. Mille Plateaux Les Edition de Minuit, 1980

[*9] For more, see following references in addition to the original texts by BOULEZ;

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[*10] An example is that the author had dealt with "SCHOENBERG-BOULEZ Puzzle for singing and speech" in the middle of 90's and from the point of dynamical transition of spectra, got general musical solution.

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