Committee 6
Science and Music: A Unifying Concept

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Systemic Approach of the Influence of Classical Music on the Development of Emotional Intelligence

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Abstract

Classical Music and Transactional Analysis, one of the main sciences of human behaviour, would possess a hidden unity. We can observe a structural and a dynamical isomorphism between themselves. This underlying union would constitute the active principle of music's positive effects on our emotional intelligence.
Within a symphonic orchestra, exchanges between instruments follow rules of human communication, as they have been defined by Dr. Eric Berne, founder of Transactional Analysis. "Parent, Adult and Child ego states", and "Transactions" are the most known concepts.
Some passages are a conversation between two or several voices such as individuals would talk to each other on a "non-verbal" level. In a Mozart's piece, a cello expresses a Parent ego state with a jerky music, full of reproaches, the flute answers as a Child by expressing joy and unconcern, and a bassoon ends the exchange (Adult ego state) with a regular rhythm and an "explanatory tone". We are here in the heart of musical interpretation. All the human emotion range and way of communication can be found: joy, anger, fear, sadness, reproaches, softness, explanations, etc.
The systemic approach, conceived thanks to cybernetics, mathematical logic and theory of systems, will guide us to discover correspondencies between classical music and transactional analysis. Systemic is considered as the science of the unification of sciences.
The main systemic concepts are : System and Element, Interaction, Feedback and Homeostasis, Principle of Totality, and Organization.
Using classical music as a tool for the emotional and relational intelligence can develop our sensitivity, perception of nuances, and our understanding of the complex human relationship.

Introduction

Does an underlying unity exist between classical music and human sciences, based on an isomorphism of structure and rules ? Can these correspondences be used for the development of our emotional and relational intelligence, allowing in return the greatest musical creativity ? Is the listener a part of the musical piece ?
In this study, we will see how the systemic approach, constructed with the help of concepts from cybernetics, mathematical logic and complex system theory, can help find answers to these questions.

Our civilization, for centuries, many musicians have sought to establish reconciliations between music and science. Bach, and Mozart have used mathematics to compose some of their works. Modern researchers and composers, like Xénakis, have been able to create real masterpieces. Others have analyzed existing works with the help of mathematics to reveal the underlying logical beauty, undertaking thus an opposite work.
In all cases, these interdisciplinary transfer operations have allowed the emergence of novelty and beauty.
Thereafter, human sciences such as linguistics, psychoanalysis and experimental psychology have been applied on various musical pieces. The results are the basis of many papers.
To continue this exploration, we have compared the structure and the dynamics of classical music with that of transactional analysis, all done in a systemic perspective. This work has never been attempted until now.
Transactional analysis, one of the main disciplines of human sciences, has the specificity to have scientifically modelized what happens when people communicate between themselves. Invented by Doctor Eric Berne and developed by many researchers such as C. Steiner, S. Karpman or J. Dusay, transactional analysis allows one to describe, to formalize, to understand, and to anticipate relationships as internal dialogues.
Out of the different music forms, we have chosen to work with instrumental classical music (symphony, concerto, duet, …) because it is a rich and relatively known example of what it

is possible to create with music. A symphony, the 40th from Mozart for instance, allows lively and emotional reactions, possesses themes and various rhythms, proposes various instrumental tones, multiple and simultaneous voices, and a well-structured organization. Finally, It provokes finally interesting effects on the emotional capacities of a listener.

By using the systemic approach, we have obtained our results: showing a real structure and functioning kinship for these two disjoined universes .

More over, these results allow us to imagine the use of classical music as a development tool for the relational and emotional intelligence.

Remember that our emotional intelligence expresses our capacity to feel emotions, our ability to express them, and also perceive the emotions of others with all their nuances. Emotional intelligence can therefore express to the introspective and relational level, these levels becoming indicators that we will retain.

1. - Music and Science of Human Behavior: in Search of a Hidden Unity

To reveal an isomorphism between two disciplines, it is necessary to choose criteria of comparison and interdisciplinary analysis tools.

Systemic approach has the advantage of being universal, transdisciplinary and scientific in its foundations. Systemic is often considered as the science allowing the better unification of sciences. Its basic concepts have been elaborated from biology and cybernetics, and are today being applied in many areas such as physics, mathematics, economy and sociology.

Among the main concepts useful for our research, we can note: System and Element, Interaction, Feedback and Homeostasis, Principle of Totality, Organization.

These patterns will guide us in this comparative study associating music and transactional analysis.

The listener will be voluntarily excluded from the system studied, because a piece of classical music reflects first the emotions of the composer, the personal vision as a mean of expressing a message.

1.1. - Elements and System

A symphony or a chamber music is a system, composed of elements such as instrumental voices, in mutual interaction. These different voices produce as a whole, music.
A human group or a community is a set of people in mutual interaction exchanging sounds which support information and emotion.

Do instruments converse within an orchestra like conversation within a community, following similar rules ? Can we find a similar parallel for improvised music, as we have found for composed music ?

Exchanged words are accompanied by a music, the one of the voice. Communication sciences show exchange is mainly built by "the manner of the message, how it is expressed" rather than its content. The manner of a message is determined by the rhythm, the height, the intensity of sound, of what is told by someone to another, like a symphony.
Psychologists are especially interested in the non-verbal level, and mainly in the musical component of communication to better understand it and anticipate it. It is this aspect, called "the process" which generally determines the quality and the result of exchange between people.

For Further Inquiries, we can look to the "Ego state" and "Transaction" concepts from transactional analysis. This approach is a model of interaction between people in a group, a theory of personality and a tool for changing and involving human systems.
It allows us to analyze relationships between people, called "transactions", and to understand how people manage the complexity of reality. Transactional analysis was conceived 50 years ago by Doctor Eric Berne, a psychiatrist, who developed it as a rational method allowing the description, in an integrative language, of the complex human behavior.

1.1.1. - "Ego State" concept

When a person sends a message, he/she uses a tone, an expression, selecting personal words. When we look beyond appearances, one classifies these manners of expression according to three registers: expression of a child, expression of an adult, expression of a parent.

Each register of expression corresponds to typical attitudes of a child, an adult and a parent. This is not an arbitrary cutting. We have all had a childhood. The child is still alive within us, located in a part of our ego. According to different situations, we can activate our Child ego state (noted with a capital as for any ego state) which is going to express the here and now.

An ego state, as defined by Eric Berne, is a coherent set of thoughts and feelings directly associated to a coherent set of corresponding behaviors. It is a way of expressing an aspect of our personality at a certain moment. Three ego states have been observed for each of us: the Child (symbol E), the Adult (symbol A) and the Parent (symbol P).

Structural Analysis describes what happens inside a person, his/her feelings and internal dialogues. Their experiences as a child, an adult or a real parent. Content of ego state is defined by this approach (mainly used in therapy). Combined like dolls, an ego state is composed itself by a Child , an Adult and a Parent ego state corresponding to a previous age, and so on for this Child within the Child. The model is as follows: an ego state E0 (the somatic Child, 0-1 year old) is located inside an ego state E1 (1-5 years old), and is located in the ego state E 2 (5-12 years old) of the person as an adult. All these ego states remain alive and can be activated throughout life.

Systems Analysis describes what happens outside, on the behavioral level. It details what is apparent for others, what is happening to a particular person. It defines the process.

Five behavior patterns and five functional ego states have been observed as a direct expression of structural ego states. The Critical Parent, the Nurturing Parent, the Adult, the free Child, the Adapted Child. These modes of expression classify the totality of possible behaviors of human being interaction.

The Child ego state is the first state to appear. Its behaviors, thoughts and feelings are reproduced from a person's childhood .

The Adult ego state has behaviors, thoughts and feelings corresponding to the here and now reality. It records and processes the information of all external (environment), as well as internal origins (from its Parent or its Child). It uses this information to compute probabilities, to take decisions and to evaluate results.

The Parent ego state integrates thoughts, emotions and behaviors a person has learned from their relatives and the parental figures in their childhood.

How to recognize Ego States ? According to Eric Berne, an ego state can be used according four levels:

- The behavioral diagnosis (by analyzing words, intonations, gestures, clothes, postures, mimicries,...).
- The social diagnosis (by deducing his own ego state thanks to the reaction of the other managing his own stimuli).
- The historical diagnosis (comparison of the present behavior with behavior adopted in the childhood or copied from real relatives, or both).
- The phenomenological diagnosis (by exploring memories and the past).

The behavioral diagnosis is the most important and the three others confirm it. It is essentially based on images and sounds sent by the person expressing.

1.1.2. - Music expresses its "Ego States"

A musical instrument "talks" and produces a speech. Therefore, expressions from a violin or clarinet, analyzed like people in communication, are similar to functional ego states. This correspondence can be due to the fact that the characteristics of an ego state are non-verbal from a person, or the "music" of their words.

Of course, other parameters, such as gestures, attitudes or words do not exist for instrumental music. But this is largely compensated for by the sonorous possibilities of each instrument, which greatly exceeds those of the human voice. The diversity of each

instrumental tone, the combination of instruments, variations of height and intensity, the speed of note execution, allows a vast variation of expression and nuance.

Some examples include an isolated instrument, a group of instruments or an orchestra demonstrates the Parent with a jerky music, full of "reproaches", the Child by expressing joy with the light sound of a flute, the Adult with a non-expressive bassoon, with a regular rhythm and an "explanatory" tone. We are in the fields of musical interpretation. All the human emotional range and forms of communication can be found: joy, anger, fear, sadness, reproaches, softness, explanations, and so on.

1.2. - Interaction

In systemic, the concept of interaction is central. A group whose elements do not interact is only a collection of juxtaposed individuals. This is what happens when the members of a society become selfish and individualistic, for example. It doesn't allow anymore new qualities to emerge and takes away from the simple addition of new members.

Question: Are the rules of instrumental interaction within a musical piece similar to those which govern communication between people ?

1.2.1. - Transaction Concept and Rules of Communication

When two people communicate, they exchange transactions. A Transaction is defined as an elementary unit of social action constituting one stimulus (verbal or nonverbal message) and one reply. Each of us possesses three ego states, which implies there are virtually six people, not two conversing in the same room . All combinations are possible, but when a person expresses from the Parent, they often solicit the Child state of the speaker. If the targeted ego state aimed at is the one which replies, it is called "complementary transaction". For example, when one gives an order and the person obeys. The person can also rebel by expressing her Rebel Adapted Child.

Now, if the Adult ego state of the first person receives in return a reply from a Child while the Adult had initially solicited the Adult ego state, it is called a "crossed transaction" .

Finally, two ego states can express simultaneously and communicate to a double level: the social level (which first appears) and the psychological level (hidden communication). Energy is nevertheless mainly invested at the social level. This exchange is called "ulterior transaction".

1st rule of communication: when transactions are complementary, communication can continue indefinitely. The targeted ego state aimed at is the one which replies.

2d rule of communication: when transactions are crossed, communication is interrupted or takes another direction. We take another theme.

3rd rule of communication: It is the psychological level first which determines the quality and conclusion of communication.

1.2.2. - Musical transactions

Instruments in an orchestra communicate also between themselves within a symphony or during an improvisation. They exchange music instead of words. Some musical passages are dialogues between two or several instruments in which one can sometimes recognize the expression of a Parent or of a Child, according to the inspiration of the composer. The most surprising discovery is that these dialogues seem follow the transactional rules governing human communication as studied by social sciences.

The three rules of the communication previously presented can also be applied to the relationships between the various voices of an orchestra, produced by the soloist or groups of instruments. This is particularly apparent in concerto.

Thus, a lead instrument, a guitar for instance, exposes the theme in the concerto of Aranjuez. The main melodic theme is resumed by the orchestra with force and vigor. The guitar continues the dialogue. The orchestra replies with a crescendo repeating the first with a different tone.

Sometimes, a confrontation can be visualized (competition between two Parents, complementary transactions). Later, the sweet and weak solo guitar (Child) is accompanied and sustained by the music of strong and kind orchestra (Parent) (complementary transactions).

If the aggressive wind instruments (brasses for instance) give a dry, ditactorial response after several pages of a sweet and regular guitar melody, we can expect the end of the exchange and transition to another part. We have observed this can effectively be produced in the musical field. It is the musical equivalent of a crossed transaction.

Finally, an ulterior transaction can be found in a musical piece, when several voices are heard simultaneously. In this case, one of them is more dominant than the others.

The composer can decide to bring the weakest voice to the forefront. The voice of an instrument lost in the massive sound (the psychological message) can then determines the reply of a whole orchestra. In the relationship with the listener, the third rule of communication is in action when the accompaniment, and not the main melody, provokes the strongest reaction. During the first measures of Ravel's Bolero, the almost inaudible accompaniment is nevertheless a capital voice and is going to take the forefront at the end of the piece. The hidden message emerges with time and replace the social message.

1.3. - Principle of Totality

According to this principle, a whole is different, superior or inferior, with the addition of its parts. In social psychology, groups also follow this principle of totality. The former will be able, for example, to realize some tasks because it will have competencies stronger than the simple addition of individual competence. A group socializes in this manner. All can not be made alone, other people are complementary necessities for reaching our personal goals. The whole supports emerging qualities that do not exist at the level of basic elements (persons). The creativity of a team, friendship, love is something that exceeds individual members of a group.

In music, the symphonic creation can not be reduced to the simple addition of its parts. Symphonic creation possesses a structure, organization, depth and capacity to touch stronger than those of voices juxtaposed. The resonant orchestral volume differs from the simple linear addition of the resonant intensity of its elements. The tone of a group of voices, the violins for example, is richer in harmony than the sum of each violin's elementary tone.

In conclusion, a real cacophony rises from a musical set as voices of each present a high musical quality. In this case, the whole is less than the sum of its components. It is a question of organization. The adjustment is very sensitive. We only need an instrument which does not start simultaneously with the others.

The whole work of the composer consists in the introduction of instruments, tones, melodies in such a manner that the whole produces a magical effect, impossible to decode by listening to each instrument separately.

1.4. - Feed back and Homeostasis

In human sciences, and more particularly in social psychology, relational stability phenomena, often rigid and strict, can not be statistically explained. Position of each individual's interaction with the other, is consolidated by regulations, often invisible feedbacks, which maintain the system despite external perturbations. Of course, a system can be the subsystem of another.

When these underlying feedbacks are not taken into account, important negative consequences can occur.

Within a musical set, there is a circular causality between some voices taken two by two. For example, the melody of a piano is the causes the cello's response, which respond to maintain the "speech" of the piano. There will be a positive feed back, if the rhythm accelerates or if the resonant volume increases, and at breaks the end. This exchange can end with a long silence, where another instrument initiates a new musical passage. This positive feedback would have been an infernal spiral leading to the break of exchanges between voices.

At another moment, negative feedbacks can be lead, contrarily, decrease the speech of a flute to reach a musical balance. The force of a orchestra thus compensates what the flute can say with its sweet and sharp little voice. These feedbacks can be undertaken on the rhythm or the speed level, the height of notes and the resonant intensity.

"Symphony", as a system, can be self regulated by reacting to any internal or external perturbation with the help of regulating mechanisms returning it to its initial state. The

whole musical piece can change from "level 1" but also "level 2", to resume the works of Palo - Alto researchers (Mental Research Institute).

A change of first level corresponds to an improvement, a modification inside the same general framework that remains unchanged. It is often a transitory phenomenon. Along the musical speech, a rhythm or tonality change, a modulation, represents this kind of change. The general structure and the homeostasis of the symphony is stabilized. Returning to the initial tonality is frequent in this case.

A level 2 change corresponds to a rupture of the system, a structural modification of its framework. It often provokes anxiety, fear, because the system evolves toward a very different and unknown state.

1.5. - Organization and Hierarchy

In a human group, the organization can allow a system to be more than the sum of its components. It is also necessary to account for the internal hierarchy, the role of leaders and their effects on other parts of the system.

1.5.1. - The concept of Life Position

In transactional analysis, life position is defined as the set of basic beliefs taken by a person on herself and on others, and used by herself to justify her decisions and her behavior.

Four Life Positions have been observed:

I am OK, you are OK, (+,+) position: I am a valuable person and others (relatives, friends, colleagues,...) are valuable people. I do not play games with other people. I respect him entirely. I am confortably intimate with him. I act with a responsible, realistic and constructive manner. I have confidence in my capacities. I fully realize my potential. I believe deeply in my emotions, ideas, values. I interested in cooperation, not competition.

I am not OK, you are OK, (-, +) position: I am not valuable, others are better than me. I do not like myself. I want to be liked by others first. Actually, I am submissive and dependent on them. I am victimized. I feel guilty, inferior, contemptible, depressive, suicidal, rejected, stupid. I am dominated . My needs become demands.

I am OK, you are not OK, (+,-) position: Nobody has any value but me. I dominate. I identify myself to others with greatness and prestige. I am perfect and original. I am susceptible, aggressive and lack sensitivity. I adore power, to feel strong and dynamic.
I am not OK, you are not OK, (-,-) position: We are not valuable, neither myself nor others. I am resigned. I take a spectator point of view of myself and life. I am touched by nothing. I fall easily into withdrawal and disinterestedness. I am afraid of changes and rejection.
I smoke and drink too much. I can not be happy. I am unproductive, destructive and self destructive.
People are not locked into one position. During the day and according to events, they go back and forth between any one of these fours positions. Nevertheless, they all have a dominant position called a basic life position.

1.5.2. - Music and Life Position

A musical instrument, or the voice expressed by it, can also have a dominant, dominated or cooperative position. According to the composer's inspiration and the desired result, each instrument will have its place in the hierarchy of the group and must hold it, changing position occasionally. The "life position" classification established for social exchanges seems relevant to music. A voice can be naturally dominant, for example, in a concerto written specifically for an instrument. In the case of a symphony, some instruments (violins) can be leaders comparable with many other instruments (the bass or the flute for example). Nevertheless, beyond this "basic life position" specific to each instrument or to each voice of the partition, each can access, predominantly the other life positions with variations of music.(+/+), (+/-), (-/+) and (-/-) positions are taken from the place of each in the partition, the time given by the number of measures to express, its resonant intensity (forte, mezzo forte, piano,..), the fact to solo at some moments or be always drowned in the mass. In this organization, musical harmony is threatened if a voice does not respect the position it has received. This order corresponds to the organization of the system.

2. Consequences on the Development of Emotional Intelligence

Until now, we have only considered the musical voices which converse amongst themselves, according to rules of communication within an ordered organization.
Now we will focus on a larger system composed of two main elements: listener and music.
Musicotherapy has shown, indisputably, the positive influence of classical music on the psyche in a curative way (struggle against stress, insomnia, depression, obsessional trends, …) and for the development of psychic functions (memory, learning, reasoning, expression of emotions, relational abilities, …).
These last examples concern what Daniel Goleman calls "emotional intelligence". He designates, at a structural level, our capacity to feel emotions, to distinguish them, to express them, to accept our faults and, at a functional level, our capacity to perceive other's emotions, to understand and to anticipate our relationships with others and other's lives.

The underlying isomorphism, or union, of classical music and of transactional analysis constitutes, according to us, the active principle of music's positive effects on our emotional intelligence.

By making "social" harmonious exchanges between instruments, a concerto, a symphony or a quartet educates, and may repair our relational abilities with a subliminal learning process. By listening to rich and subtle music with various modulation, variation, harmonics, we reactivate our deepest emotions and access corresponding ego states, like a catharsis during a psychoanalytic work. Moreover, we create make energy by moving between our ego states and develop our intuition located in our ego state called "little professor" by Eric Berne (the Adult (A1) into the Child (E2)).

In this "music / listener" system, music can be understood as the speech of a virtual person with their own ego states, telling a story to a listener.

For example, our E0 (somatic Child in the first months) or E1 (Child aged of 1 to 5 years old) ego states can be touched thanks to a music which resembles the nonverbal speech of these ego states. This contact can be made by the simulation from E0 (music) to E0 (listener) or from E1 to E1 (parallel transactions) or thanks to a very archaic parental expression of a musical passage, as "Ogre Parent" noted P1 stimulating the Child E1 of the listener (complementary transaction P1 to E1).

Concerning these musical ego states, remember this diagnosis is are possible because classical music possesses expression and nuance capacities much richer than those of the human voice, compensating for the lack of gestures, attitudes and characteristic words (cf. "musical ego states").

The main criteria in retaining ego states of a musical piece, as a gestalt extracted from a context, are as follow: height of sound, resonant volume, value of notes, rhythm, tonality, movements (adagio, allegro, ...), crescendos and decrescendos, tone (composition in harmonic), musical system (tonal, atonal), and mode (major, minor).

Combination of these criteria give the six functional ego states:

Nurturing Parent: soft , warm and comforting music.

Critical Parent: strict, aggressive and structured music

Adult: inexpressive, analytic and informative music.

Free Child: light, happy, expressive and humoristic music.

Submit Adapted Child: standard, regular and weak music.

Rebel Adapted Child: original, lifeful and aggressive music.

These characteristics are only examples among the different possibilities to express ego states. There is many ways to behave, for example such as a Critical Parent or a Rebel Adapted Child.

Moreover, from a listener to the other, the impact will not be always the same. For a listener, the same passages could be experienced differently according to the chosen instant. We can link these variations in the listener's abilities to activate his ego states according to the musical stimulations.

The more complex the music is, in a systemic way, the more important the development of emotional intelligence.

These results can be obtained by listening to music, but especially by the practice of an instrument in the participation of an instrumental set (duet, trio, quartet, orchestra).
Positive results can be important and rapid. By practicing improvisation within a group, one can arrive at remarkable communication and expression of persons working to improve their personal growth, but also of some autistic patients.

Conclusion

In this study, we were looking for a better understanding of links between music and sciences. We have focused specifically on classical music and a major discipline of human sciences, transactional analysis. Remember transactional analysis is a model of what happens between people and inside people.
An isomorphism, structural and functional, can be found from this reconciliation. Classical music is not a continuation of sound gathered by accident. Classical music is an organized system as a whole, whose characteristics can not be found within its parts. Internal regulations allow it to present a coherence. Instrumental voices, following and combining with each other, create various soliloquies and dialogues according to shapes and rules similar to those developed by transactional analysis.

Thanks to this underlying unity, rules in the construction of a musical piece can be better understood as its harmony, its beauty, its coherence and the reasons of its effects on a listener. Music can thus be used as a tool for developing emotional intelligence and thanks to the specificity of transactional analysis.

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