CONCERT HALL EVOLUTION AT THE CLASSICAL AGE AND BEYOND: A PERSONAL VIEW

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1 INTRODUCTION

During the Renaissance, a new musical concept emerges in Europe: the concert. "Music moves into concert halls when it can no longer be effectively heard out of doors", writes R.Murray Schafer. "There, behind padded walls, concentrated listening becomes possible. That is to say, the string quartet and urban pandemonium are historically contemporaneous."

The thesis sounds fascinating. But is this enclosure of musicians in strongholds, attested later in the names of famous halls - such as "Bastille" and "Redoutensaal" - confirmed by musical evolution? Do we observe during the Renaissance a modification of musical writing that corresponds to new performance venues?

Beyond any doubt, concerts made it possible for composers to use a new effect - or at least, an effect that was not attested hitherto: *expression*. Whereas organ and plainchant, just as dance music and the troubadours' instruments, do not play nuances, Gabrielli's *Sonata pian e forte* attests that, at the end of the XVIth century, musicians had understood that they can play with "volume" in a room: soft sounds appears intimate; loud sounds fill up the room. Thus, the listener gets the feeling of "being in man's work like a fish in water, being totally immersed within it, living in it, and belonging to it", as Paul Valéry expresses it three centuries later; and further: "were you not enclosed with it [Music], and forced to be, like a Pythia in her smoke chamber?"

From that point onwards, the movement is constant: increasing the power of musical instruments, increasing the size of the orchestra to increase its power; increasing the size of the hall to accept more listeners. These evolutions are intertwined, as Ekhard Kahle proved. The movement reached its climax in the XIXth century with gigantic halls - the Royal Albert Hall is the only remnant of this period - and gigantic orchestras - 1022 musicians for Berlioz at the 1844's World Fair! This is further attested in history - figures of 6000, when not 7000, are circulating for the Salle des Machines at the Tuileries Palace in Paris at the end of

the XVIIth century. Its modern avatar is reinforced music which, for the first time, decouples sound power from the number of musicians, and makes it possible to give concerts for some hundred thousand listeners in stadiums!

2 HISTORICAL FACTS

2.1 Musical evolution

History, unfortunately, does not support the thesis overtly. Musical evolution at the Renaissance carries on along the line of musical evolution during the Middle Age: polyphony, and counterpoint. The third part is introduced in the XVth century, and a radical modification appears in the XVIth century - but one cannot speak of revolution: parts are no longer treated successively, but simultaneously, which allows dissonance and leads to the definition of harmony one century later. The evolution is similar for religious music and madrigal, and nothing indicates an influence of the performance venue on this evolution. Moreover, at that time, *concerto* designates both religious music and madrigal...

First with the Classical era , a fundamental modification takes place: "Among the most striking features that distinguish harmony after about 1730 from that of the Baroque era are the slowing down of harmonic rhythm, the change in function of the bass and the presence of a formally constructive harmonic technique [...]. The fact that the rate of harmonic rhythm (measured as the average distance between changes of harmony) became slower was associated with the stylistic ideal of *noble simplicité* [...]; at the same time, it was necessary if the tonal outline of larger-scale form was to be accessible to a public comprising more ordinary music lovers than connoisseurs", writes Carl Dalhaus. As for the bass, "expressed with emphasis, [it] took the guise of an audible signal of the intended tonal function [...]". In reaction to a change of public, this is the first indication of an influence of the performance venue on musical composition: the last 30 years or so of research have proven that the "volume" effect - soft sounds are intimate, and loud sound enormous - is basically a low frequency effect. The striking coincidence is that around 1730, the phenomenon of concert spreads out through Europe and beyond.

2.2 The concert hall

In the middle of the XVIIth century, a new phenomenon appears in England: the public concert. Cromwell's revolution had indeed deprived England of Court life, and musicians began playing their music in more relaxed environments: houses, colleges, or even taverns. In 1676, the first public concert hall opened in London in the York Building.

The example rapidly spread to the rest of Europe: concerts organized by Teleman in Francfort in 1723, *Concert Spirituel* organized by Philidor in the Swiss Room of the Tuileries Palace in Paris in 1725; and even to America: concerts in Boston in

1731. A specific architecture dedicated to concert was developed in its wake and reached its achievement with the Gewandhaus in Leipzig in 1781.

However, evolution did not follow the same path in the whole of Europe. This specific architecture long remained a characteristic of Northern Europe, first England, then Germany. Southern Europe did not develop a specific architecture: it only contributed significantly to the development of theatre, as attested by phrases such as "théâtre à la française" or "scène à l'italienne". There is no concert hall in Venice at the time of Vivaldi, and his profane works written for the Ospedale della Pieta were played in the chapel of this institution. In France, for example, the first concert hall was built much later, in 1811 for the Conservatoire in Paris; it has "the shape of a theatre, with galleries, a stage curtain and a proscenium arch. In France, indeed, concerts are often held in theatres - even to-day", concludes Michael Forsyth.

3 ACOUSTICAL DESCRIPTION OF A CONCERT HALL

It is necessary to recall a few basic concepts.

3.1 Room response

We all know that sound is created by the vibrations of an instrument that are transmitted through air. Part of it reaches the listener directly, but most of it is reflected once or more on the walls before reaching the listeners. From the listeners' point of view, the first sound arrives from the instrument directly, then from reflections on one wall, from several walls, and so on. The succession of these arrivals builds up the *response* of the room, often depicted by a reflectogramme where the intensity of each arrival is plotted against time. Remember that *the response is characteristic for a specific source position and a specific listener position*.

Traditionally, one can distinguish the direct sound, the first reflections, and the reverberation. The *direct sound* arrives from the instrument directly, at grazing incidence above the heads of the listeners sitting in front. Thus, low frequencies are attenuated, as is often the case in modern hall (seat dip effect). The *first reflections*, together with the direct sound, build the *early sound*, and create spatial impression and source broadening, as is well known. Early sound is specific for a source and a receiver - both their positions and their directivities. Last, *reverberation* is created when the density of reflections is such that a continuum is perceived, a phenomenon that arises after a time corresponding to 2 or 3 mean free paths. As a superposition of many reflections, reverberation is statistic in essence: it has the same structure in the whole room, independent of the source and receiver positions and directivities. Therefore, one needs only a few parameters to describe it, such as frequency-dependent reverberation times and *reverberation levels*. Reverberation levels are fixed by the room shape: the more

early reflections are created by adequate reflectors, the less is the reverberation level in the room - unless reverberation enhancement is called upon as becomes more and more frequent. Notice that this evolution comes from studio technique, where on line reverberators are part of the standard equipment: all sound engineers admit that reverberation level is a crucial parameter for the quality of a recording.

3.2 Favouring communication: the theatre

In a theatre, good communication is essential since the audience wants to understand what the actors say on stage. Given the fast rhythm of speech, only early sound can contribute to communication - termed speech *intelligibility*. Therefore, intelligibility is improved by all contributions to early sound, like short distances between actors and the audience, or increasing the number of first reflections; it is diminished by all contributions to reverberation, such as late reflections, which must be weak. The results are modest-scale rooms: Barron, quoting Saunders, even showed that optimal dimensions are linked to the directivity of the human voice and are satisfied in the most famous classical theatres. The soffits of the balconies and boxes create many reflecting surfaces near the audience, and effectively weaken later reflections from the back walls of the boxes. The direct sound is reinforced, what Vitruvius called *consonance*: "Consonant spaces are those that, helping the voice and increasing its force as it raises, bring it clear and distinct to the ears."

However, the circular shape of the italian theatre probably comes from social usages: largely attested in literature - as in Proust's famous scene of the duchess's baignoire - people came to theatres and operas to be seen, not to listen or look at the performance. Distinguished attendees used to sit on the stage in the early days. In the Opera Garnier in Paris, a small sitting room still exists at the entrance of each box...

3.3 Favouring reverberation: the church

In Roman Catholic churches, communication between human beings is secondary: most important is to be surrounded by a mysterious aura of sound that facilitates a religious trance. Valéry describes it very well: "in this enclosure and in this universe of sounds, it is like being out of ones self ... [...] as [in] a temple built around your soul". The reference to fusion with divinity is obvious.

Acoustically, fusion is enhanced by the lack of early sound and the long reverberation. In a church, walls are far away and the volume is big, so that sound is not easily localized: sounds revolve, as smoke in the Pythia's chamber. Vitruvius called it *circumsonance*: "Circumsonant spaces are those where the voice, being enclosed, whirls away and vanishes and does not sound articulated".

This circumsonant acoustic is particular to Roman Catholic and oriental churches. In Protestant churches, communication has taken over and some churches are built like theatres; or rather, like ... concert halls.

4 CONCERT HALLS

4.1 An acoustical synthesis

The first concert halls remain modest in dimensions. They look like bare theatres. Only at the end of the XIXth century do concert halls reach the dimension we now know, achieving a synthesis of two kinds of spaces: theatres, and churches. Indeed, the concert hall takes over the main trait of each of these spaces. And the major halls of the Golden Age - Amsterdam's Concertgebouw, Vienna's Grosser Musikvereinsaal, and Boston Symphony Hall - are notorious for blending the two aspects: communication, and reverberation.

Good communication, essential in theatres where the audience wants to understand what the actors say on stage, is preserved in the concert hall - albeit to a lesser extent, better suited to a less demanding message: music. In good concert halls, the walls surrounding the orchestra, and to a lesser extend the audience, are designed with care to enhance the sound "in consonance": arriving from lateral directions, and compensating for the deficient direct sound at low frequencies, the reflections on these walls contribute to the "volume" effect that animates crescendos. In a similar way, the mysterious aura of sound that envelopes listeners as in the church, and helps getting "out of ones self", is essential to the concert hall: good halls are large enough to ensure immersion in music - without reaching the colossal dimensions of the Gothic cathedrals.

4.2 Music as a religion

A remarkable coincidence is that concert halls acquire their religious aura of sound at the very same time when religion looses its predominance as foundation for society. The Golden Age of the concert hall, as represented by Amsterdam's Concertgebouw, Vienna's Grosser Musikvereinsaal, or Boston Symphony Hall, is contemporaneous to Nietsche's proclamation of the death of God. It may be a simple coincidence, but I am tempted to interpret it as the substitution by Schopenhauer's "spirit of music" of the religious spirit.

As Harold Marshall once remarked, the status of concert halls at the eve of the XXIst century is comparable to the status of the large Gothic cathedrals. He further adds that many great modern acousticians are or were religious persons. A further hint that music is one of the religions of our era!

5 TOWARD TYPOLOGY

Let us now sketch a typology of performance halls.

5.1 Theatres

5.1.1 The antique theatre

The antique theatre is not a hall, properly speaking, since there is neither roof nor side walls. Therefore, there is no reverberation or "volume" effect. Remember that antique music was very different from our modern orchestral western music. Japanese No music probably gives a better idea. In the antique theatre, sound is naturally amplified by frontal reflections on the orchestra plane and on the back stage wall. As the slope of the tiers is steep - about 30 degrees - visibility is excellent and low frequencies are not attenuated by the audience. The lesson is forgotten by many modern designers, unfortunately.

5.1.2 The classical theatre

At the end of the XVIIth century, the theatre *à la française* - théâtre du Maris, 1644 - is a rectangular hall, long and narrow, with a high ceiling. Two or three balconies are installed around the hall, narrow on the sides and deeper on the back wall. The stage is high - 1.5 to 2 m above the floor. This shape is inherited from royal tennis and disappears one century later, replaced by the circular or elliptic theatre *à l'italienne*.

Important features of the classical theatre are: their modest dimensions -1400 seats at Garnier in Paris; the Baroque decoration that diffuses sound; the narrow boxes that attenuate the sound penetrating them; the free volume between the last circle and the ceiling, that creates reverberation; and the proscenium arch, that blends and projects sound of the orchestra into the audience. Sculptures - and forestage boxes - are therefore useful on the proscenium arch, which also links the stage to the auditorium visually.

5.2 Churches

The church is the second type of hall, and its link to the concert, as attested by the *Concert Spirituel* - which was not played in a church, though - is still actual. If Protestantism in Northern Europe lead to churches that favoured intelligibility - Copenhagen's Christianskirke is built like a theatre with three ranks of boxes - Southern Europe has always preferred reverberant churches. As musicians love playing in beautiful spaces, Romanesque and Gothic churches are used for concerts. These spaces are lacking early reflections completely, and the results remain ... "circumsonant": only church music is adapted to such spaces.

5.3 Concert halls

5.3.1 The classical concert hall

The classical concert hall is a rectangular hall, long and narrow, with a high ceiling. Two or three balconies are installed around the hall, narrow on the sides and deeper on the back wall. The stage is high. In other words, it is a true copy of the theatre *à la française* in the XVIIth century, though it has been considerably enlarged in the classical halls (the old Gewandhaus in Leipzig 1781, Boston 1890, Vienna and Amsterdam). There is, however, probably no direct affiliation.

We all know what the important features of the classical concert hall are: the narrow width and the shallow balconies, that reflect sounds from the side and downwards; and the high ceiling that offers enough volume to create reverberation.

5.3.2 Modern halls

Modern halls depart from the classical models since all architects must create original works to-day. A classification of such halls is therefore difficult.

Most prominent among modern halls are the so-called directed reflection sequence (DRS) halls: large reflectors hanging on the side direct the sound into the audience - hence the name. The reflectors divide the hall into two spaces: a lower space where the audience is seated; and an upper space where reverberation is created. Thus, both intelligibility and reverberation can be optimized - at the expense of the reverberation level, however.

6 CONCLUSION: THE FUTURE OF THE CONCERT HALL

What future do concert halls have? Some acousticians are pessimistic and predict concert halls the same future as beached whales... The most optimistic consider that future halls will rely on electronics more heavily.

6.1 The introduction of electronics

A change took place several decades ago, and has gained momentum ever since: the introduction of electronics in performance halls, first as sound reinforcement and now as more elaborate systems that create reverberation artificially. Classical musicians are still reluctant to it, but the trend has come to stay: it allows acousticians to override the architects in some sense.

6.2 Deaf architects

Acousticians often complain of architects: they are deaf, and do not listen to the space. More precisely, they do not listen to the recommendations of the acoustician, which inevitably leads to a catastrophe - according to the acoustician. Indeed, it is often too late for the architect to listen to the acoustician, because the latter was called on too late, or because changes have occurred in the program after construction has begun.

6.3 Blind acousticians

Electroacoustics and electronics makes it possible to obtain results hitherto unheard of in halls: uncoupling the acoustics of a hall from its architecture! By concealing loudspeakers in the ceiling and the walls of dry halls, acousticians can now transform sound spaces without asking architects - remember that they are deaf. In this way, a theatre can become as large as a cathedral, without loosing intelligibility; or give the illusion that a small group of instruments is large enough to fill up a large hall. However, any attempt to transform a cathedral into a small theatre has failed so far.

6.4 The danger

Anyone that has trained her/his listening to surrounding space through long practice is unhappy with such an evolution. Moreover, decoupling audition from vision is hazardous: it strengthens the deafness of architects and the blindness of acousticians. The examples of the past teach us that a successful hall requires the conjunction of a great architect with a great acoustician; that is, the conjunction of an architect that does her/his best to translate the recommendations of the acoustician in her/his own architectural language, with an acoustician that does her/his best to understand the vision of the architect. This is the price to pay to realize a "great" hall!

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