Proceedings of the Institute of Acoustics

WAGNER AND THE CINEMA: A COGNITIVE APPROACH TO THE ACOUSTICS OF THE BAYREUTH FESTIVAL THEATRE

JD Polack
M Retbi

Institut Jean Le Rond d'Alembert, équipe LAM
Université Pierre et Marie Curie/CNRS UMR 7190/
ministère de la culture et de la communication
Paris, France

1 INTRODUCTION

Ever since Harold Marshall told us in the 1960s of the importance of lateral reflections[1], we have believed – and taught to our students – that lateral sound was the Holy Grail of concert hall acoustics. Indeed, at lest for our generation of acousticians, we were reinforced in our conviction by the fate of the late Avery Fischer Hall in New York. But is that so? Can acoustical quality exist in the case of frontal sound only?

What we regularly teach to our students is the following: Have you experienced to sit at a concert, to think that the orchestra plays really well, but nevertheless to think that the concert is boring? If it happens again, look around you, and you will unmistakably realize that the hall is very large with a low ceiling – typically a factory hall or a sport arena used for a so-called popular concert – that is, you will realize that there is no lateral reflection!

This trend toward lateral sound has invaded the entertainment business so much that we now find it in motion-picture theatres, with the generalization of Surround sound and THX. Indeed, it is quite surprising to find oneself in one of those old-fashioned motion-picture theatres, as one of us did recently, and to experience sound from the front only. The first impression is always an impression of bad sound quality. And yet?

Very quickly, we forget it and get wrapped in the story!

2 THE CASE OF BAYREUTH

In fact, it is exactly what happens in the Festspiel theatre in Bayreuth. One of us recently had the privilege to sit at several performances during the Festspiel season 2009. He had anticipated something great, and indeed, it was a great experience. But most of all, he wanted to experience by himself the presence or absence of lateral reflections in the Festspielhaus. Indeed, from all our experience of theatres and concert halls, we could hardly believe that the side recesses inside the Festspiel theatre could produce any lateral sound of significance – even without taking into account the extreme width of the Festspielhaus, 33m (Figure 1), in comparison to the major opera houses of the time: 22m or so at San Carlo in Neapel, La Scala in Mailand, or Opera Garnier in Paris.

This privileged experience gave the expected answer: there is no lateral sound to be noticed in Bayreuth, but only some reverberation that, with focused attention, can be heard coming from the space above the side recesses, since the partition walls do not reach up to the ceiling. And yet, as for motion-pictures, one quickly forgets it and gets captured into the show, like wrapped in the story.

3 THE CASE OF BAYREUTH

How can we forget the frontal sound in motion-picture theatres? One man has investigated the question for many years, and has developed a convincing answer published in different publications: Claude Bailblé, from the Université Saint Denis in Paris. And his answer is not based on acoustics, but on cognition, that is, on the high-level functioning of the human brain.

In order to understand Bailblé's answer, it is important to recall the difference between a story seen on the motion-picture screen, and a story perceived in real life. In real life, the human observer, according to Bailblé[2], has three degrees of freedom to explore the world:

- by moving his/her eyeballs, he/she can explore the viewing window opened in front of him/her;
- by rotating his/her head, he/she can orientate his/her sight in different directions and explore the surroundings – in motion-pictures, the camera and the mounting (cuts) replace the head movements
- by walking around, he/she can move closer or further away from the scene – in motion-pictures, travelling, and changing field-sizes (shots), play this role.

Early motion-pictures, such as the Lumières' cinematograph, made use of the first degree of freedom only. This is most evidently the case of theatre and opera performances, where spectators sit trapped on their seats, looking at the stage in front of them. Whenever they rotate their heads, the show disappears – at least in our modern performances where light is turned out during the performance, as it was from the very beginning in Bayreuth, an unusual feature at the time. But in Bayreuth, not only the suppression of light, but also the suppression of distractions such as the sight of side boxes and decorations, limit head rotations and concentrate attention onto the stage. Besides, the narrow stage creates a relatively narrow view field, less than 30 degrees on average at all seats, that makes head rotation useless and helps concentrating on depth perception, which is further stressed by the slopes of the room and the stage, as will be explained later on.

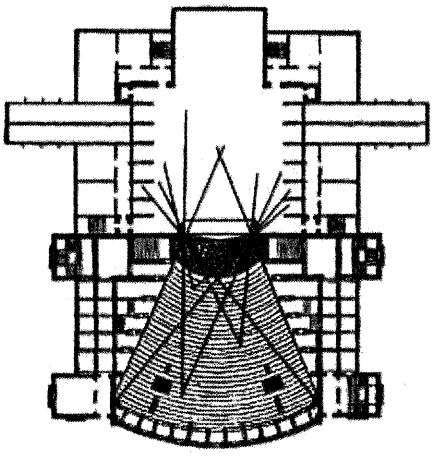

Figure 1: Sight lines in Bayreuth
the centre of curvature for the seating rows is located at the back of the stage.

Indeed, the most innovative aspect of the Festspielhaus plans, when compared to contemporary projects or even to the preliminary projects, is the fact that the curvature of the seating rows is reduced. As a consequence, the centre of curvature is moved to the back of the stage (Figure 1), whereas it was located in front of the stage in the Greek theatre or in the early projects (Figure 2) of Semper[3]. It results in a view field that is concentrated on a narrow but deep zone of the stage, compared to the classical disposition where the stage is almost out of sight for spectators on the edges (Figure 2).

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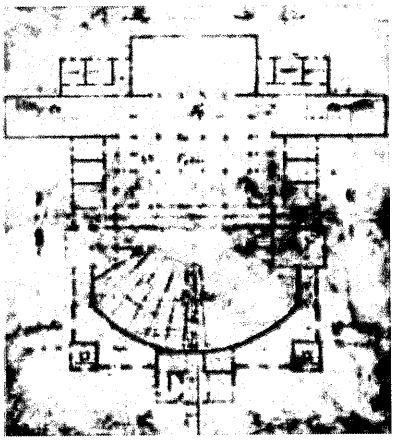


Figure 2: Semper's project for Wagner's theatre in Munich (left) and Brückwald's early project for Bayreuth (right)

But this innovation is not the whole story. Let's have a deeper look at the cognitive approach to the perception of motion-picture performances[2]. When looking at a motion-picture, the sitting spectator is continuously changing from an "omniscient" point of view (he/she looks from outside, like the narrator) to an "internal" point of view (he/she looks from within the characters, and experiences their conflicts, feelings, emotions, etc.). The camera, by changing shots, moves the spectators from one point of view to the other. Reality is thus cut in shots and scenes, which have to be connected within a single narrative discourse: for Bailblé, emotions construct the film, as through a mental montage within the spectator.

The addition of sound to the motion-pictures made it possible to compose with a different type of mental images. Thanks to sound, so Bailblé, the scene protrudes beyond the screen, and eventually surrounds the spectator *visually* – even in the traditional case of monophonic diffusion through a unique central loudspeaker behind the screen. In return, the picture dictates to the sound a position *in* or *off* screen, with the benefice of a real scenic extension. However, this position *off* screen remains very blurred with monophonic diffusion, and often reduces to a sensation of proximity or distance; besides, masking blurs the discrimination of simultaneous sources. As a result, the perception of space is reduced.

With the introduction of multichannel sound in motion-pictures, focalised listening is restored together with width and depth of sound plans, and even creates sound envelopment. Pitfalls are "dis-location" – the source jumps from one position to another – and "dis-traction" – sharp *off* sources catch attention.

In an other text[4], Bailblé adds that sound editing in motion-pictures virtually displays the sound sources around the spectator. If this is the case, there is no need for lateral sound in motion-picture theatres: as stated in the introduction, spectators forget this lack of lateral sound very quickly and get wrapped in the story! Translated into acoustical terms for concert halls, this simply means that there is no need for lateral reflections when vision primes over audition, as is the case for operas.

In other words, sound editors must handle surround sound with care, and mostly rely on the auditory perspective that made monophonic soundtracks work perceptively. This auditory perspective is twofold, and can be divided into: a *hierarchic* perspective, linked to source power (and not to their size); and a *depth* perspective, linked to distances. By playing with level and masking, sharpness and fuzziness, by strengthening significant details, and the like, sound editors set sound sources in perspective, bringing to the spectator's mind clues that verify or falsify his/her expectation, and open him/her to anticipations. In other word, the sound track winds up the visual inferences[4].

4 BAYREUTH FESTSPIELHAUS

In 1941 Paul Viereck[5] wrote that "the originality of Wagner consists in the adaptation of the romantic values to another age: not a past age, nor his own age, but an age to which his sensitivity foresaw a spiritual and material mechanization." For Wagner, all the arts have to contribute to the total illusion. Theatre is the place of illusion, and first of all, the place of the illusion of the senses, which are waken up by the magic of the stage. For that purpose, as Bailblé would say it today, Wagner places the spectator in a "in-position", completely "fixed" and immersed in the depths of the stage. His aim precisely is this immersion. In Bayreuth, this immersion is partly obtained by the multiplication of the prosceniums, which in turns creates an illusion of scale. This is explained in the latest essay on the acoustics of the Festspielhaus[5], which provides us with some information about the genesis of the theatre and the origin of its side niches.

When the court-architect of Sax-Altenburg, Otto Brückwald, started working on the Festspielhaus in 1872, he had at his disposal some preliminary sketches drawn by Gottfried Semper, the architect of the Dresdner opera. However, so Wagner, no decision had been taken for the lateral walls yet, nor for the "ugly corners" left and right from the proscenium. Semper had developed a double proscenium in his sketches, in front of which, as he related it himself, "actors, when they step to the edge of the stage, visibly exceeds terrestrial size because the eye is inclined to measure size not according to real scale, but according to the reduced scale of the smaller interior proscenium". This well known optical illusion is illustrated by Figure3.

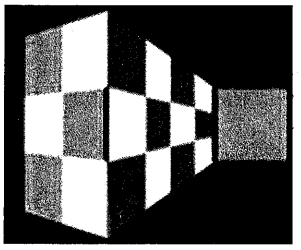


Figure 3: Optical illusion: which vertical black line is longer?

For Bayreuth, the stage machinist of Munich, Carl Brandt, recommended the sevenfold repetition of this stage portal that unfolds with distance from the stage. These lateral devices, jutting out into the auditorium in the manner of stage flats and getting gradually shallower, should direct the view of all spectators toward the stage, and contribute to create the illusion that the stage is within the auditorium and that the auditorium is extended by the stage flats. They also contribute to "de-lateralize" the music.

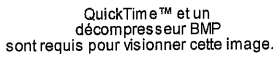


Figure 4: The sevenfold stage portal

A particular feature of these lateral devices is that they do not reach to the ceiling. The best guess for an explanation to this disposition is, according to Baumann[6], that Wagner hoped that it would develop a positive acoustical effect similar to the warm sound he had observed behind the stage of the Paris Conservatoire. Wagner has told that, in 1840, he came late to a concert at the Paris Conservatoire, and had to wait in the backstage, which was separated from the orchestra by a rather high wall that did not quite reach to the ceiling. The effect of the orchestra sound led over this acoustic baffle had surprised him extremely, and gave him the idea to recreate a similar effect for the orchestra of a theatre to be built one day.

There is, however, a conceptual difference between the coupled rooms of the Paris Conservatoire, where the indirect sound nevertheless sounds clear and intense inside the antechamber due to its good acoustics, and the Bayreuth Festspielhaus where the listeners sit in the auditorium itself. According to Baumann, the zone between the partition walls works like reverberation chambers, in which sound penetrates and which sound leaves again after several reflections, in order to enrich the sound quality of the main hall. She reckons that the effect is positive probably because the partition walls do not reach up to the ceiling. Indeed, we have mentioned earlier that some reverberation can be heard coming from the space above the partition walls, but not from the niches themselves!

5 THE "MYSTISCHER ABGRUND" – "MYSTICAL ABYSS"

It is strange to read about the experience of Wagner at the Paris Conservatoire in connection with the sidewalls in Bayreuth. One would rather expect a connection with the sunken orchestra pit that Bayreuth is reputed for. However, Baumann[6] has very good reasons not to make this connection: the concept of sunken pit had been around since the second half of the 18th century. For example, Claude Nicolas Ledoux, the great French architect of the Revolution, proposed a pit that step-wise sinks under the stage, and Karl Friedrich Schinkel drew such a sketch for the renovation of the National Theatre in Berlin, with the annotation: "Sinking the orchestra two feet deeper [about 60 cm] is of utmost interest for the effect of music, the different instruments blend better together due to the confined space in which they play, [...] Most remarkably, the singing on stage will be more dominant, whereas it is nowadays completely covered by the overtones of the close-lying orchestra. Also the musicians working in front of the stage will not appear so disturbing." Last but not least, the theatre in Riga, where Wagner was musical director from 1837 to 1839, had a similar sunken pit.

It is not the right place to discuss here the implication of the sunken pit for the orchestra composition, and we refer to Baumann's article for a complete discussion[6]. What is important to our topic is the influence of the sunken pit on sound quality. This influence precisely is what Schinkel

described: the redirection of the orchestra sound leads to a strong darkening of the sound, the low frequencies being diffracted by the cover of the pit and reaching relatively undisturbed the auditorium, while the cover screens off the high frequencies of the instruments nearly completely. And this muffling of the high frequencies, this lack of brilliance, makes the instruments sound more distant, that is, it set them in perspective with the singers. This perspective is further strengthened by Wagner's orchestration, which makes use of the perceived power of the different instruments to suggest different distances[6].

The sunken pit is also a "mystical abyss" in another sense, since the orchestra becomes hollow and invisible, both in the proper and the figurative senses of the words: the music, mixed by the pit, comes from the depths of an abyss, from the lowest and deepest part of the auditorium/stage space. Wagner[7] described this effect with the following words: "thanks to an architectural artifice [the image seems] remote, as inaccessible as an appearance in a dream... while a mysterious music emerges like a spirit from the mystical abyss". And the staging indications in his opera, such as in the Rhine Gold, direct towards "the thickness of darkness, the depth of crevasses which must be guessed, the continuity of the flow of the waves... ".

But abyss and perspective do not fully account for the perception of the orchestra in Bayreuth. In fact, as Bailblé explained it for motion-pictures, vision dictates to sounds positions *in* or *off* the viewing window, with non-visible sources being allocated positions *off*. Since the sunken pit hides the music instruments, the mind allocates them positions *off*, with the benefice of a real scenic extension beyond the stage dimension – a sort of virtual spatialisation. But this spatialisation remains very blurred, often reducing to proximity or distance in agreement with the acoustical characteristics of the sunken pit.

However, careful listening shows that some instruments are localised around the frame of the stage opening, due to reflections on the proscenium sidewalls and ceiling, a disposition which is not visible in the original plans of Bayreuth, nor in older drawings[8] (Figures 5 and 6). In fact, the voices of the singers are heard as through a veil of orchestral sound filling up the whole stage opening. But this veil remains rather frontal.

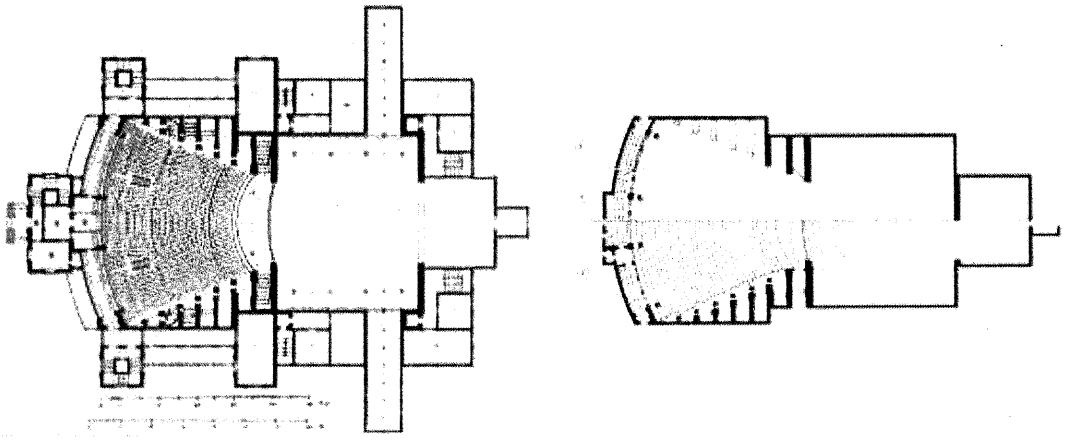
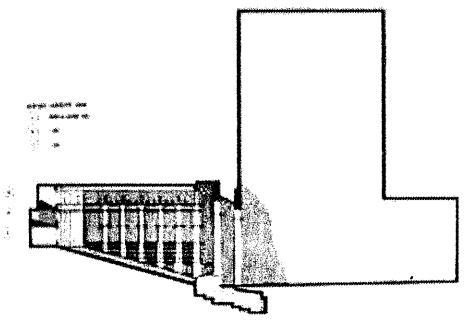


Figure 5: Original Festspielhaus plan[8] (left) vs. present plan[9] (right); notice the oblique wall that now close the first proscenium



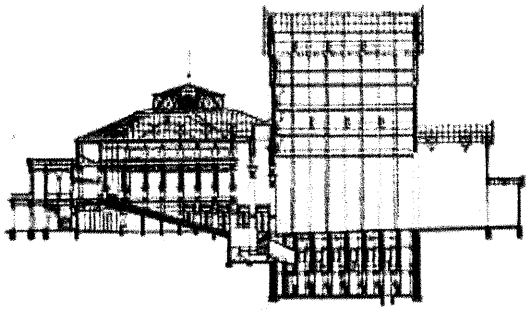


Figure 6: Original Festspielhaus section[8] (left) vs. present section[9] (right)
notice the oblique wall that now close the proscenium

At this point, if we try to sum up the acoustical effects of the two main features of the Festspielhaus, the sunken pit and the side niches, they amount to increasing the perspective of the performance, while reducing "dis-traction" by suppressing lateral sound and relying on virtual spatialisation. Can we trace back these acoustical effects in the writings of Wagner and his contemporaries?

6 OPERA AND DRAMA

An interesting source of information about the reception of Wagner in Europe is given in an essay by Baudelaire, *Richard Wagner et Tannhäuser à Paris*[10]. Comparing three descriptions of Lohengrin Overture, written independently by Berlioz, Liszt, and himself, Baudelaire focuses on resemblances, and points out five. Among them, one concerns "the feeling of the *space extended until the last conceivable limits*" (Baudelaire's Italics). He then adds "No musician excels, like Wagner, to paint space and depth, materials and spiritual."

In his own writings, more specifically in *Oper und Drama* which Baudelaire read in its English translation, Wagner[11] does mention depth in connection with music, albeit in connection with harmony: "the unfathomable depth of harmony". Thus, harmony is compared to a see, on the surface of which melody makes its apparition, and "we have to consider the orchestra as the tamed flow of the harmony". This opposition between melody and harmony has far-reaching consequences for Wagner: "If we let a melody sung by a human voice be accompanied by instruments in such a way that the essential component of the harmony, which lies in the pitch-span of the melody, is taken away from the harmonic body of the instrumental accompaniment and must be supplemented in the same way by the melody of the singing voice, then we become immediately aware that the harmony is incomplete and that the melody at the same time is not incompletely justified harmonically, because our hearing perceives the human voice automatically *segregated* from the instruments, due to the large difference between their perceptive tone qualities, and thus only receives two disparate experiences, an harmonically incompletely justified melody, and a lacunars harmonic accompaniment. This extraordinary important and never yet consistently considered observation is able to explain a large part of the inefficacy of the opera melodies of the past, and to teach us something about the many mistakes we have committed in the construction of sung melodies in opposition to orchestra." We have quoted the whole passage[11], because it sets the orchestra in perspective with the singers.

7 CONCLUSION

The originality of the Bayreuth Festspielhaus, built at an age when stage directors and acoustics experts did not exist for theatre yet, lies in the fact that its architectural features were brought upon

by Wagner's search for effects, his will to use them in his works, and his comprehension of the acoustic or architectural considerations of his contemporaries. In all these aspects, his vision transcended tradition, thus reaching modernity. This modernity is also at work in the several approaches we have presented in this essay, that all converge toward one teaching: the importance of perspective in Wagner's operas. In order to focus the attention of the spectators to the stage and what happens there, Wagner deliberately, in his compositions and in his theatre, turned out every sources of "dis-traction": incomplete harmony of the accompaniments, musicians in front of the stage, sidewalls, even light during the performances. By so doing, he relied on the sole narrative montage of his composition, as in modern motion-pictures. Thus, sound spatialisation remains virtual, no side sound "dis-tracts" the spectators because there is nothing to see in the theatre: no Duchess of Guermantes, sitting in her ground-floor box as in Proust.

Why then are listeners not bored in Bayreuth? Precisely because they are not listeners, but foremost spectators, to which Bailblé's analysis[2] thus applies: they construct a mental montage from within, cemented with their emotions. Here again, Bailblé is not far from Wagner[11], for whom music is a mean for the expression, and for whom "the resonance of harmony to melody convinces the feelings": in Wagner's operas composed after the publication of *Oper und Drama*, recurrent Leitmotivs will conduct the feelings and emotions through the story narrated on stage by the singers. In a similar way, Baudelaire[10], quoting Liszt, talks of "the capacity which music exerts on the hearts by awaking all the range of the human feelings". A few lines later, he comes with the final words: Wagner adds to the charms of music "some of the pleasures of the spirit; but at the same time he prepares more perfect emotions to those who can taste them." This is why the listeners/spectators are spell bound in Bayreuth!

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