# THE CONCEPTUAL ACOUSTICAL DESIGN FOR LA PHILHARMONIE DE PARIS, GRANDE SALLE.

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## 1 INTRODUCTION

The conceptual acoustical design for La Philharmonie de Paris, Grande Salle has its origins in 45 years of acoustical discovery and research. The architectural/acoustical competition instructions required "a new typology" for a concert hall. This paper describes the winning concept, realized by architects Ateliers Jean Nouvel, and traces its partial precedents in several well-known concert halls. The paper concludes with quoted comments from the international press around the time of its opening on January 14th. Unfinished though aspects of the building were at that time, the reports were consistently positive.

My colleagues and I have divided the task of reporting into three; corresponding roughly with conceptual design, design development and commissioning. This section reports mainly the initial stages but for the concept to have persisted as it has in the face of some significant challenges from external agencies one can infer my colleagues' and my, on-going commitment to it. In that sense every stage is conceptual.

## 2 THE "PROGRAMME ACOUSTIQUE"

The only concert hall acoustic project I have been involved in with a full technical specification prior to design was the Orange County Centre for Performing Arts (opened 1986). Under the guidance of the CRS Group (Houston TX) and the Blurock Partnership (LA) an exhaustive study session called "Problem Seeking" produced a design guideline of some 50 pages. When I expressed some misgivings at the initial "Design Squatters" meeting I was reassured by Charles Lawrence the Lead Architect. He said, "We want the building to be fully responsive to its acoustical needs". [1]

For the Paris project, after the initial competition to shortlist the architectural/technical teams, a technical specification for Acoustical Design was distributed to the participants. That arrived (in English) just before we left to take part in the initial design session – literally the day we left!

### 2.1.1 Review of the Programme Acoustique [2]

I studied this on the plane between China and Europe. (The preceding 12½ hr flight from Auckland left at 1 minute to midnight and arrived in Shanghai next morning.) The preceding paper to this one has dealt with the contents of the programme in detail but it is reviewed briefly here.

As I read through it I realised that the central ideas by and large described the acoustic properties of coupled spaces of which there were several examples in the US, NZ and Europe.

### 2.1.2 Principal requirements

In addition to the reflection efficiency parameter the Programme Acoustique called for a number of other architectural and acoustical constraints to be met.

- In the first place had to be the requirement that a new typology was required – with all the recognised types specifically excluded.
- It required a surrounding seat layout.
- Independent control of the (acoustical) presence of the source and the presence of the room to the audience and performers.
- It required clarity *and* reverberance
- Adaptability for all musical genres.
- Approximately 1400 $m^2$ "efficient surfaces".

In the Christchurch Town Hall which opened in 1972.[3] the new parameter proposed by the authors for reflection efficiency seems to be fulfilled. Here is the first page of my notebook with sketches and notes made on that flight. There are several historically significant points to note. One is that the "room within a room" as a possible solution to the requirements of the brief is there from the start.

# 3 PRECEDENTS

We must start by congratulating Trevor Cox on his blog which identified these precedents correctly.

## 3.1 Christchurch Town Hall

The Christchurch Town hall, already 40 years old had demonstrated the feasibility of the listed requirements either actually or potentially and contrary to long-held conventional wisdom. Its design was predicated on providing un-masked lateral reflected orchestral sound to 2750 seats. This was achieved by the large interior reflectors, directing reflections on paths remote from grazing incidence on the audence. Incidental to that aim, they had the effect of separating the early part of the reflected sound from the later reverberation and thus gave the possibility of independed control of each as required in the PdP briefing document.
Probably the most striking result was unforeseen, in that in a reverberation time in excess of two seconds unamplified speech was intelligible to an excess of some 2000 listeners. Subsequently this effect was measured and quantified.

It is also noteworthy that at the time this Hall was in design the only recognized acoustic metric was RT. All the others we use today were invented subsequently. But Clarity *and* Reverberance remain the most noteworthy of all its acoustics properties. For the first time it seemed possible to have uncompromised multipurpose halls. (I recall that Bill Allen used to speak of such spaces as "Multi-purpose Hells.")

## 3.2 Berlin Philharmonie.

The Berlin Philarmonie was a another important precedent for the programme. It strikingly emphasied the importance of a strong architectural idea. (Architect Hans Scharoun, acoustician, Lothar Cremer.) [4]The "vineyard" metaphor resonated with everyone and not just the Rhinelanders to whom it must have been so familiar! And for me it was crucial in confirming the importance of lateral reflections as contributors to a premium listening experience. There are places in the seating where such reflections are absent, and others where they are abundant. This produces a striking (to me at least) difference in spatial impression. Both Berlin and Christchuch have surrounding seating.

## 3.3 Lucerne

KKL Lucerne[5], also by architect Jean Nouvel, is a Russell Johnston, coupled reverberant volume room with ample lateral reflected sound from the rectangular plan, narrow width and multiple horizontal balconies. The so-called "cornice reflection" from these must be significant. As with all the Johnston rooms of this genre, the reverberant chambers, some 7000 $m^3$ couple to the main space through massive openable wall panels. It is noteworthy that one of the authors of the

Programme Acoustique, Eckhard Kahle, was heavily involved in this project from the start and has continued with it in subsequent “tuning” exercises. He knows how frequently the openable doors are moved - my impression (which I have seen elsewhere) is that variables tend to be used until the novelty wears off and then remain set in a mode that accommodates most functions. We also believe that the view into the main space through the reverberant space may have alerted Jean Nouvel to the possibility realised in PdP.

# 4 PROCESS OBJECTIVES

The Rayleigh Lecture yesterday commented extensively on the MDA attitude to architecture and acoustical design and will not be repeated here. Central is the rejection of the idea that there is only one possible form for a successful hall. And only one “proper” sound. If the process is successful, it follows that the architects also “own” the solution as is the case here.

## 4.1 Coming to a concept.

At design workshops with the architects and other consultants early in 2007, there were several moments when ideas crystalized. These generally involved drawing, as far as the acousticians were concerned – the architects were reluctant – a “first” in my experience. The following sketches (with all their limitations) sufficed to allow the conversation to proceed.

### 4.1.1 Initial sketches:

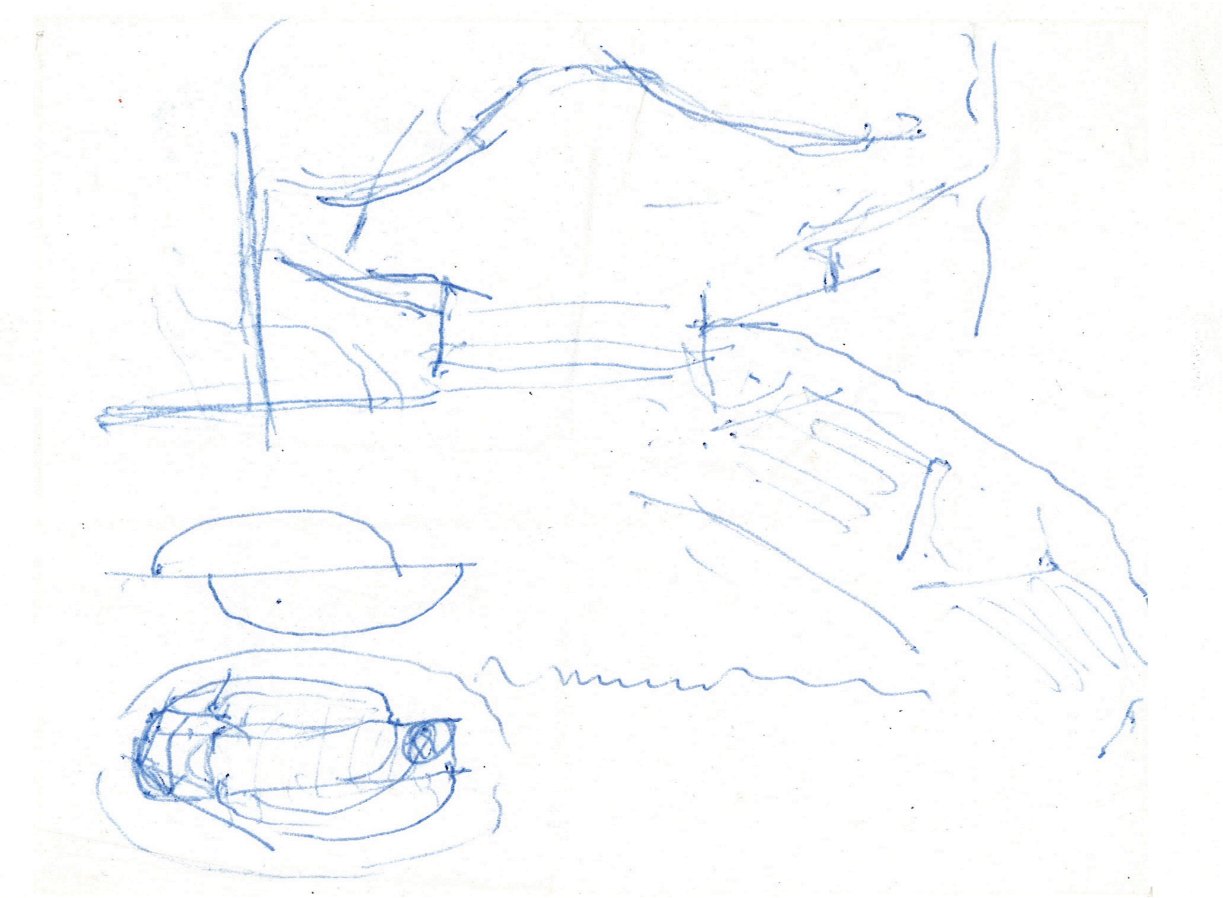

**Figure 1** Exploring the bicameral idea, asymmetry and entry through the reverberant outer space

### 4.1.2 A trial cross-section :

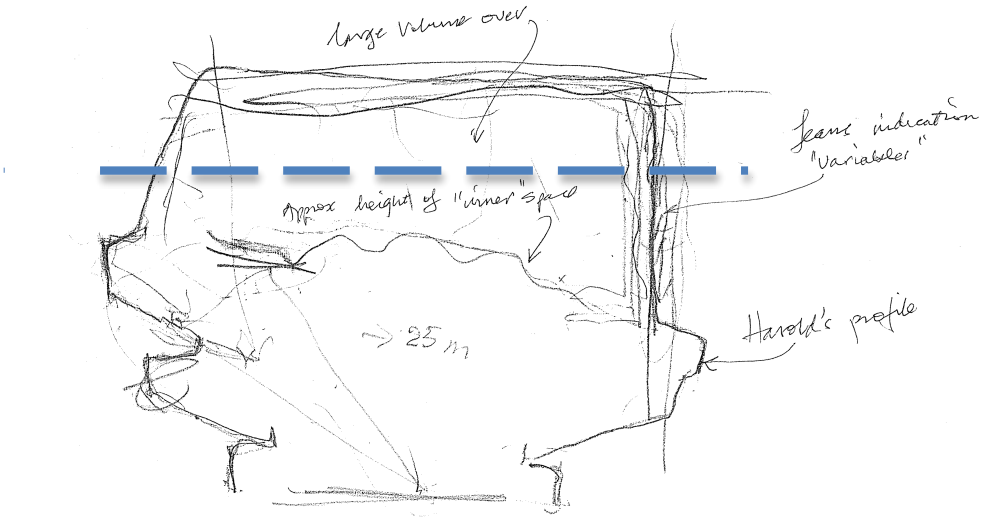


**Figure 2**
Surrounding the seating areas with direct reflections largely elevated lateral, and second order reflections to serve each seating area, with a reverberant volume above – to be the site of "adjustables". Note that at this point it was not clear to us that there was an absolute planning height limit at approximately the broken line on the slide.

### 4.1.3 Distributing the reverberant volume in response to the reduced height:

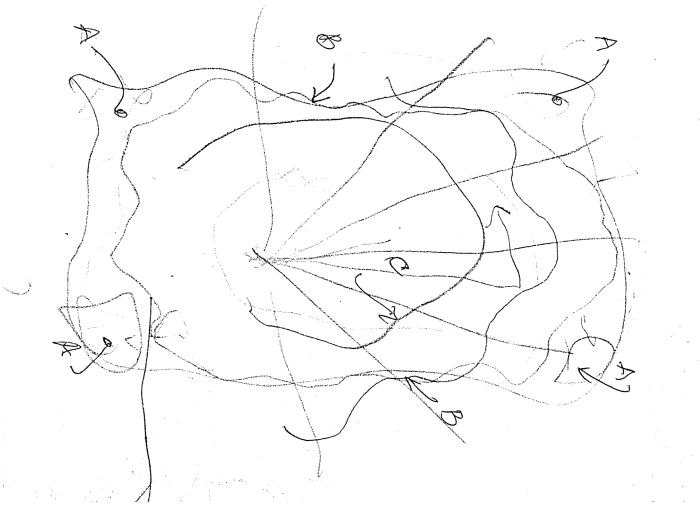


**Figure 3:**Sketch plan of the distributed bicameral spaces, the richness of the architectural ambiguity, and the lateral distribution of the reflections from supposed overhead surfaces. See also the detailed description in the following paper.[6]

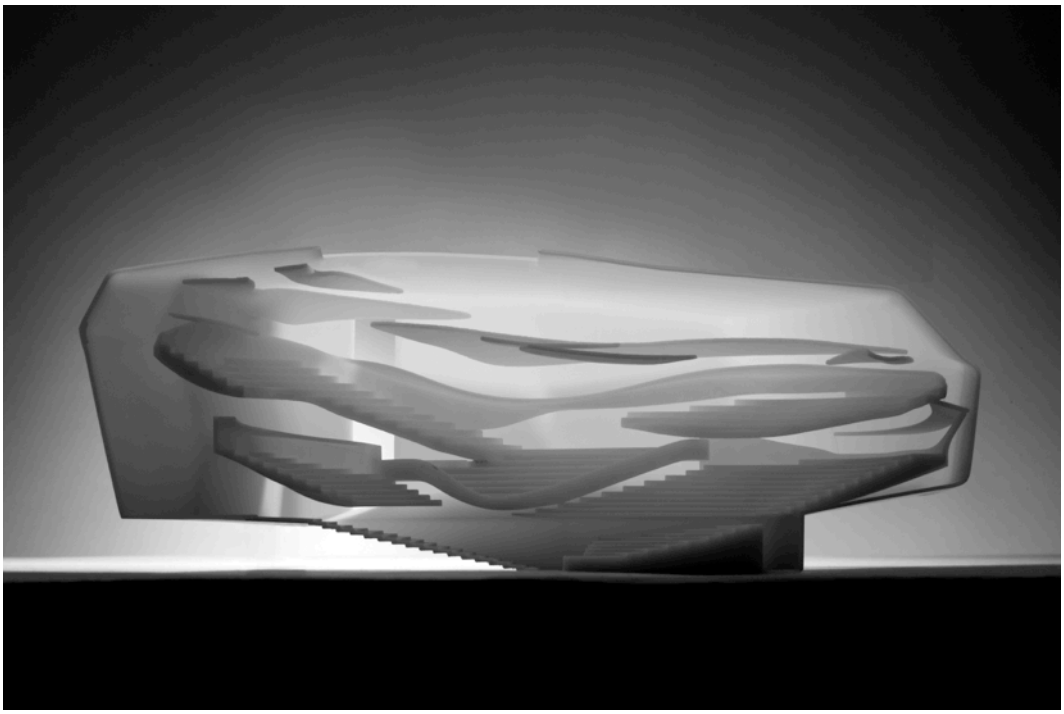

**Figure 4**

The competition 3-D printed version of the bicameral space.

**Figure 5**
The architectural render of the competition interior space. Provides visual and acoustical intimacy between performer and audience. Every seating area served with predominently lateral reflections.

**Figure 6:** Outer space with its own architectural and acoustical presence – control of the late reverberant sound.

# 5 THE WINNING DESIGN:

The solution proposed was found in two nested chambers [7]– an inner space producing visual and acoustical intimacy between audience and performer and an outer space with its own architectural and acoustical presence.

**5.1 The acoustical adaptability required by the programme**:

- The late sound field adjusted primarily by deploying up to 1500m2 of frequency balanced acoustical absorption in the outer space and on the back of reflectors.
- Changes in coupling between the spaces by movable elements such as the canopy and other suspended reflectors in the acoustical interaction zone.
- The early sound field will be adjusted by moving the acoustic reflectors as diagrammed and deploying absorption on near-stage surfaces or facing the stage.

Lateral energy is provided to the stalls by the cliffs and to the balconies by cornice reflections from the reflectors integral with the seating plane and other second order reflections via overhead reflectors and side walls.

**5.2 The suspended reflectors, the cliffs, and the stage reflectors**,
provide the necessary surface area within 15m of source/receiver to meet the 'Early Acoustic Efficiency" requirements. This is described in detail in the following paper.
Diffusion (low-mid, mid and high frequency), graded from maximum near sources to minimum on remote surfaces, will be distributed throughout the concert hall.

# 6 DESIGN DEVELOPMENT

Over the following 7 years the design survived the stress of a highly politicised project. The following paper gives an account of the implementation of the concepts and the prediction of the corresponding metrics. The principal casualty was the loss of some of the variables we had proposed, loss of the shaping in the outer space to optimise the coupling between outer and inner, and reduction in the available area for the absorptive drapery. These were compensated in part by a substantial increase in the area of the nuages (suspended reflectors) to a gross area comparable to the projected plan for Christchurch. The resulting space is however, recognizably the winning design inspite of these variations. There is plainly enough of the intention realised "to work". The elements lost will be available as evolutionary developments in any successors.

# 7 OUTCOMES

Several circumstances in 2014 prevented my attendance at the turbulent opening of this hall on January 14th 2015. From the point of view of reporting on the success of the design, however, that enforced absence has been an advantage. It permits one to report only independent observations and opinions. The universal applause with which the acoustics have been greeted in the course of 270 performances of music in all genres has not faded for the balance of the 2015 season. Yesterday the Rayleigh lecture concluded with one example of these. The slide reports excerpts from the initial review by the same author, Tom Service, in The Guardian[8]. I am looking forward to hearing my first performance in this, the result of 8 years of travail.

# 8 REFERENCES

[1] Paoletti, D, Hyde, JR & Marshall, AH *"The acoustical design of the Orange County Performing Arts Centre"*. Proc. 11th ICA, Paris, July 1983

[2] E Kahle and R Denayrou, Kahle Acoustics and ALTIA, authors.

[3] Harold Marshall, *"The acoustical design of Christchurch Town Hall"* Building Acoustics, Vol 21, 01, 2014.

[4] Lothar Cremer: *Die akustischen Gegebenheiten in der neuen Berliner Philharmonie.* In: *Deutsche Bauzeitung*, 70. Jg., Nr. 10, 1965, S. 850–862

[5] http://en.wikiarquitectura.com/index.php/KKL_Luzern

[6] T. Scelo, "*The implementation of the acoustic design for la Philharmonie de Paris, Grande Salle*", Proc. Auditorium Acoustics, Paris (2015)

[7] Quoted from the original acoustic report in the competition submission.

[8] http://www.theguardian.com/music/tomserviceblog/2015/jan/15/la-philharmonie-de-paris-new-musical-social-future-paris