

Article

# Advantages and Disadvantages of Surround-Type Concert Halls

Robert Harris <sup>1,2</sup>

<sup>1</sup> Theatre Projects, London NW5 2SW, UK; rharris@theatreprojects.com

<sup>2</sup> Rob Harris Design Limited, Winchester, UK; info@robharrisdesign.co.uk; Tel.: +44-7534-109-168

Received: 8 April 2019; Accepted: 14 June 2019; Published: 22 July 2019



**Abstract:** Following the significant number of new shoebox-type halls that opened in the last decades of the 20th century, the first decades of the 21st century have seen large concert hall design and construction dominated by halls in a surround format. This typology is characterised by the audience surrounding the concert platform, with a significant percentage of the audience seated to the sides of or behind the platform. These halls often use vineyard-style terracing. This paper discusses some advantages and disadvantages of surround halls, with respect to both acoustics and wider performance aspects. The perspectives of audiences, performers and hall operators are considered. Factors include acoustical quality, equality of audience experience, multiple performance genre use and ticket revenue. In particular, the implications of locating a high percentage of the audience behind the concert platform are examined. This is because, in most surround halls, a significantly higher percentage of the audience is located behind the platform as compared, for example, to shoebox halls.

**Keywords:** concert hall; surround hall; vineyard; advantages; disadvantages

## 1. Introduction

In contrast to the significant number of new shoebox-type halls that opened in the last decades of the 20th century, the first decades of the 21st century have seen the design and construction of large concert halls dominated by halls in a surround format.

Halls with a surround form feature a significant percentage of the audience located to the sides of or behind the platform. This paper discusses some advantages and disadvantages of these halls, with respect to both their acoustics and to wider performance and operational aspects. The perspectives of audiences, performers and hall operators are considered. It is hoped that the paper will be useful to stakeholders involved in determining the basic form of a new concert hall.

There is no fundamental need to locate a significant percentage of a surround hall audience behind the concert platform. What is needed is enough seats behind the platform for the performers to feel at one with the audience, a shared artistic experience. Choir seating can often adequately provide this. Notwithstanding this, several prominent new symphonic halls have a significant percentage of the audience behind the performers. This group of the audience is referred to repeatedly below.

Factors discussed below include acoustical and visual quality, equality of audience experience, the presentation of multiple performance genres and ticket revenue.

## 2. The Audience Experience

### 2.1. Initial Impression

#### 2.1.1. Advantages

First entry into a hall with a surround form can elicit a number of positive reactions:

- A sense that the hall has a smaller capacity than the actual number of seats. This can result in a feeling of visual intimacy, as discussed below;
- An interest or excitement in the non-traditional geometry. Vineyard halls often attract a bolder architectural design approach. This excitement will likely diminish as more surround halls are opened;
- A sense of democracy and inclusion, with the performers surrounded by the audience, who are seated in (sometimes) connected seating blocks, without the clear traditional hierarchy of stalls, balconies and gallery.

### 2.1.2. Disadvantages

Most shoebox halls have a clear architectural order or even grandeur, often provided by a pipe organ behind the platform (or, mainly in North American halls, by a vestigial proscenium). In contrast, surround halls often have less of a sense of visual focus. The pipe organ may be offset from behind the platform. This may be considered to be disorientating.

It has been reported to the author that some people are uncomfortable with the high rake angles that are more commonly associated with surround hall layouts. In some individuals, the steep stairs can induce an unwelcome sense of vertigo.

## 2.2. What the Audience Hears

### 2.2.1. Advantages

Listeners in the furthest seats are generally closer to the performers than in rectangular halls.

Halls in a surround form tend to have good sightlines, at least for the audience located in front of the performers. Good sightlines result in good direct sound.

Most halls in a surround form have limited balcony overhangs. This geometry avoids the poor sound associated with deeply overhung seats.

Lokki et al. [1] carried out an auralisation study in a semi-anechoic listening room, using measurements made in six unoccupied European halls, (three shoebox, three surround form) with multi-channel simulated orchestras on the halls' platforms. It is known that concert hall subjective assessors often fall into preference-based groups. Barron [2] broadly classified these into those that favour reverberance and those that favour acoustical intimacy. Lokki [1] found two groups, corresponding to preferences for reverberance and clarity. Lokki's study indicated that the clarity preference group subjects liked the high clarity and definition of the surround halls.

### 2.2.2. Disadvantages

Many experienced listeners, including acousticians and orchestral management, have spoken of the high variability in the audience experience in surround halls. Of course, as there are different listener acoustic preferences, this may also sometimes be considered an advantage.

Surfaces that provide lateral (from the side) sound reflections to listeners are known to be very important for listening to music in halls. These reflections provide a sense of spaciousness and of envelopment. Surround halls often incorporate vertical or near-vertical surfaces between seating blocks in an attempt to provide the lateral reflections that are naturally provided by the sidewalls in shoebox halls. Unfortunately, most of these smaller walls have to be aligned radial to the stage, for sightline reasons. Hence, many first-order reflections to adjacent seating blocks are non-specular and are weaker. This can result in lower early lateral energy, and hence reduced orchestral spaciousness, compared with rectangular halls.

The "natural" performer-to-audience relationship, as found through history and worldwide for informal performances, is for most of the audience to stand or sit in front of and, to some degree, to the sides of the performers. This allows the audience to both see and hear the performers well. In most performance genres, it also permits strong performer/audience interaction, but this is less important in

concert halls, where the performers are looking at the score, each other and the conductor. Surround halls tend to have many more audience members located behind the orchestra. Listeners behind the platform suffer from a number of important acoustic shortcomings. They hear:

- The orchestra image reversed, i.e., typically with the first violins to their right and the double basses and brass to their left. This is not what they perceive as normal, for example when listening to stereo recordings;
- An incorrect (compared to the usual frontal listening position) timbre from many instruments, because of the musical instruments' directivities and the variation of these directivities with frequency. The severity of this effect depends on the instrument; Barron [3] suggests that it is non-problematic for small woodwind and tympani but most serious for string instruments (shielded by their players' bodies) and singers. Beranek [4] found problems with piano, trumpets and trombones;
- Incorrect balance between the instruments (again as compared to the usual listening arrangement) is also caused by instrument directivity;
- Incorrect balance between the orchestra and soloists. This can be particularly problematic with downstage singer soloists, given the strong directivity of the singing voice, and with the high-frequency output of solo instruments being obstructed by the body of the soloist.

Each of the points above means that the audience behind the platform does not hear the work as the composer intended, except, of course for modern "spatial" work composed for surround audiences.

Audience members seated on both the sides and behind the platform are likely to suffer from a restricted view of the platform because of the raised platform surround; this also means a lack of direct sound from instruments out of their view.

The disadvantages identified in the study by Lokki [1] were that surround halls rendered music less reverberant, loud and wide than flat floor, rectangular halls. Lokki noted that the conclusions of limited sample experiments were consistent with the findings of Beranek [5].

Pätynen and Lokki [6] is a second paper based on the same study as Lokki [1]. They confirmed the hypothesis that concert halls render the performed music dynamics differently, and with various perceptual aspects. Their analysis by the hall typology demonstrated that the halls in a surround form emphasised most of the reported perceptual factors less than halls in a shoebox form. They also found that these perceptual contrasts between hall typologies were more pronounced with increased listener distance to the orchestra.

Perhaps the most interesting recent hall typology investigation paper is Pätynen and Lokki [7]. Rather than listening tests, this study used the same six halls as references [1,6], but measured a physiological response related to emotional arousal, namely skin conductance, as well as recording listening preferences. They found that rectangular-shaped concert halls evoked higher subjective impact and emotional response than the other types of included concert halls, including the Berlin Philharmonie and Helsinki Musiikkitalo surround form halls.

Some halls, such as the Paris Philharmonie, have a significant number of listeners located between the orchestra and the organ. This can result in balance problems for these listeners. Indeed, in Paris there is also a loudness issue, with the rear rows of audience sitting very close to the front organ pipes. This disadvantage may be less in the case of organ recitals, where few listeners will choose to sit with their backs to the organ, and, for such performances, a large symphonic hall is rarely full. Similarly, for large choral works with organs, it is probable that less of the audience will be seated between the platform and the organ, as the choir will occupy some of these seats.

Halls in a surround form tend to have shorter vertical room boundary walls than shoebox halls. This reduces the area available for the deployment of variable sound absorption, reducing the achievable variation in the room acoustic.

### 2.3. What the Audience Sees

#### 2.3.1. Advantages

Each member of the audience can choose their visual perspective of the orchestra, with more choice than in most rectangular halls.

As noted above, surround-sound halls tend to have relatively steeply raked seating areas and, hence, good frontal sightlines.

Surround halls tend to have shorter average and maximum audience distances to the platform. This can elicit a sense of high visual intimacy and closeness to the performers.

Furthermore, surround-sound seating tends to be in smaller blocks, which again people can find more intimate and comfortable.

#### 2.3.2. Disadvantages

Surround-sound halls tend to have prominent tier front surfaces that can diminish the important visual and psychological “density” of the audience. Similarly, density can be lower because vineyard-type halls tend to require more aisles.

As noted above, audience members to the sides and behind the platform are likely to suffer from a restricted view of the performers. This includes the inability to watch the facial expressions of soloists, including singers, and instrument fingering. The audience behind the performers often has no view, or a very restricted view, of solo instruments, particularly those played in front of the body, for example the cello, guitar, lute, clarinet and oboe.

Not all orchestras turn around during applause to acknowledge the audience behind them. Some people can be disappointed with this.

When seated behind the platform in the Paris Philharmonie, the author was distracted by the highly raked stalls and the entrance zone behind them. Reciprocally, Filippi [8] has noted that, when sitting in the central stalls of the same hall for a partially attended concert, his main visual experience when looking up from the orchestra was the multiple rows of empty rear seats.

## 3. The Performer Experience

### 3.1. Initial Impression

#### 3.1.1. Advantages

Being surrounded by the audience can be attractive to performers. The conductor Herbert von Karajan reported this to Beranek [4]. There can be a sense of a shared musical experience.

For some conductors, surround halls are attractive as they provide a physical reality to the conductor’s wish to be central to the performance experience.

#### 3.1.2. Disadvantages

Musicians, particularly soloists, may be uncomfortable knowing that a significant proportion of the audience is seated behind them and hence cannot best appreciate their performance.

### 3.2. What the Performers Hear

#### 3.2.1. Advantages

No obvious advantages were obvious to the author.

#### 3.2.2. Disadvantages

Karajan also commented to Beranek [4] that it is easier to play on a stage that is surrounded by side and rear walls and a ceiling.

Surround halls may have a significant distance (resulting in a significant time delay) between the platform and the installed pipe organ. An example is the Paris Philharmonie. This may affect ensemble playing with the organ and can be difficult for organists, particularly those unfamiliar with the hall.

A highly respected musician and managing director of a prominent orchestra has suggested to the author that a key parameter is limiting the distance from the orchestra to the upstage hall wall. In surround halls, this distance can be quite significant.

Given the limited number of vertical early reflection surfaces, many surround halls use a central sound-diffusing reflector to assist in the provision of sufficient early sound energy to the audience. It could be postulated that this results in weaker ensemble reflections than those provided by a reflector array that has been optimised for musician self-hearing and ensemble hearing. There have been reports of challenges in hearing across the platform in at least one relatively new surround hall, but similar difficulties have also been reported in non-surround halls.

### 3.3. *What the Performers See*

#### 3.3.1. Advantages

For an orchestra concentrating on the score and the conductor, the view of the audience and the hall is presumably unimportant.

For performers that engage more visually with audiences, there may be an advantage in the relatively short distance to the apparent rear wall.

Conductors may enjoy seeing more people in front of them in surround-sound halls with extensive audience seating behind the platform.

#### 3.3.2. Disadvantages

As noted above, there is probably little effect on orchestral musicians. If the platform side and rear seating blocks are in use for a show in which the performers and audience interact visually, it is more difficult for the performers to command the entire audience.

## 4. Operator Considerations

### 4.1. *Staging Flexibility and Programme Diversity*

#### 4.1.1. Advantages

If the concert hall designers have applied appropriate imagination, surround halls provide more opportunities than traditional shoebox halls for innovative spatial arrangements of performers and audience. For example, if vineyard-type blocks have removable seating, groups of performers can be located within the audience.

#### 4.1.2. Disadvantages

Few concert halls present a purely symphonic or classical music programme. A major disadvantage of surround halls when staging traditional “end stage” format performances is a significant loss of sellable seats to the sides and behind the platform. As well as a consequential loss of important revenue, this can make the hall capacity too low for presentation of the show. Affected events typically include rock and pop concerts, semi-staged opera, ballet, modern dance, conferences and convocations.

Within the symphonic repertoire, the difficulties for the behind performer audience with regard to timbre and balance can affect artistic programming, for example piano concertos.

Sound reinforcement system operation can be more challenging in surround halls. Before the performance, loudspeaker coverage must be adjusted according to the expected audience, such that unoccupied areas are not covered. During the performance, the operator, invariably located facing the platform, cannot hear the sound experienced by a significant percentage of the audience.

For staged opera performances using surtitles, additional surtitle screens are required.

## 4.2. Revenue

### 4.2.1. Advantages

Vineyard-type seating arrangements offer more opportunities for “front row” ticket pricing. The typically larger number of entrances can facilitate efficient audience movement, potentially increasing interval food and beverage sales.

### 4.2.2. Disadvantages

The considerable width of larger surround form halls and the additional circulation area required can prevent their construction on constrained urban sites that are the preferred commercial or sustainable locations. Additionally, land acquisition costs may be higher.

The main revenue disadvantage to surround hall operators that programme multiple performance genres is the loss of revenue caused by unsellable seats, as discussed above.

The author has heard comments that at least one surround form concert hall has difficulty in selling rear seats even for symphonic performances. Of course, quality of experience can be reflected in seat pricing, but it can be reasonably assumed that front view seats attract higher pricing than rear view seats. Lower rear seat pricing is not always the solution for listeners who seek a frontal viewing and listening experience.

Another disadvantage of surround-style halls is that they tend to have more individual seating areas. This can result in a need for more entry (ticket check) points and hence increased usher costs.

## 5. Factor Summary

For the reader’s convenience, Table 1 summarises the advantages and disadvantages discussed above. An asterisk (\*) indicates a disadvantage that applies to listeners behind and to the sides of the platform.

**Table 1.** Factor summary.

Subject	Advantages	Disadvantages
Audience initial impression	Intimacy, interest, inclusion, democracy	Lack of visual focus, vertigo
What the audience hears	Good direct sound Few overhangs Clarity and definition (most halls) Variability with seat location	Less spaciousness Orchestral image reversal * Poor timbre and balance * Variability with seat location Poor soloist/orchestra balance * Obstructed sound from soloists * Less reverberance and loudness Less emotional reaction Organ/orchestra timing/balance Less reverberation time variability Over-loudness of organ *
What the audience sees	Choice of view of orchestra Good sightlines (frontal seats) Visual intimacy Smaller seating blocks	Reduced audience “density” Unable to see facial expressions * Unable to see fingering * Unable to see soloists * Less contact during applause View beyond platform

Table 1. Cont.

Subject	Advantages	Disadvantages
Performer initial impression	Surround, shared experience Conductor centrality	Aware of disadvantaged audience Lack of surrounding walls
What the performers hear		Ensemble with pipe organ Weaker ensemble reflections?
What the performers see	Distance to rear wall	Lack of command of full audience
Staging and programme	Innovation and experimentation	Loss of seats for end stage shows Effect on artistic programming Sound operation difficulties More surtitle screens required
Revenue	Front row ticket premium	Limitations on hall location Higher land acquisition cost Unsellable seats around platform Increased ticket check costs

## 6. Concluding Remarks

It is currently an exciting time for new concert hall design, with non-Cartesian geometry, advanced architectural engineering and acoustic modelling techniques enabling development beyond the traditional shoebox and vineyard typologies.

The decision on hall form is determined by weighing many factors, which means there is clearly no unique right or wrong solution. For example, the disadvantages of surround-style halls with respect to staging popular music concerts and other end stage format events is much reduced if the facility also includes an end-stage hall.

Comparisons with classical rectangular halls are complicated by the fact that it takes time for halls to build the highest acoustic reputation (whether deserved or otherwise); most surround halls (Berlin Philharmonie excepted) are not old enough to have achieved a reputation assisted by history and longevity.

Surround-sound halls appear democratic visually, with the audience in interconnected seating areas, not stratified in formal, symbolically hierarchical balcony levels. Acoustically, however, they result in a clear inequality of sound experience between the favoured frontal listeners and the audience seated behind the concert platform.

Great concert halls balance architecture, acoustics and theatricality. Theatricality is generally considered to include sightlines, access, etc., but also a historical understanding and the vital audience–performer–audience relationship. In the context of concert hall form selection, it could be extended to include operational, management and financial considerations. Achieving the right balance for a particular hall will depend on the relative importance of the advantages and disadvantages of surround halls, including those discussed above, within the specific context.

**Funding:** This work received no external funding.

**Conflicts of Interest:** The author declares no conflicts of interest.

## References

1. Lokki, T.; Pätynen, J.; Kuusinen, A.; Tervo, S. Concert hall acoustics: Repertoire, listening position, and individual taste of the listeners influence the qualitative attributes and preferences. *J. Acoust. Soc. Am.* **2016**, *140*, 551–562. [[CrossRef](#)] [[PubMed](#)]
2. Barron, M. Subjective study of British symphony concert halls. *Acustica* **1988**, *66*, 1–14.
3. Barron, M. *Auditorium Acoustics and Architectural Design*; Spon Press: London, UK, 2009.
4. Beranek, L. Concert Hall Acoustics—2008. *J. Audio Eng. Soc.* **2008**, *56*, 532–544.

5. Beranek, L. Subjective rank-orderings and acoustical measurements for fifty-eight concert halls. *Acta Acust. Acust.* **2003**, *89*, 494–508.
6. Pätynen, J.; Lokki, T. Perception of music dynamics in concert hall acoustics. *J. Acoust. Soc. Am.* **2016**, *140*, 3787–3798. [[CrossRef](#)] [[PubMed](#)]
7. Pätynen, J.; Lokki, T. Concert halls with strong and lateral sound increase the emotional impact of orchestra music. *J. Acoust. Soc. Am.* **2016**, *139*, 1214–1224. [[CrossRef](#)] [[PubMed](#)]
8. Filippi, F.; Theatre Projects, London, UK. Private communication, 2018.



© 2019 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).